**3GPP TSG RAN WG2 Meeting #117 R2-220xxxx**

**Electronic meeting, 21th Feb– 3rd Mar, 2022**

**Source: Huawei, HiSilicon**

**Title: [POST116bis-e][510][Sdata] UP open issues (Huawei)**

**Agenda item: 8.6.5**

**Document for:** **Discussion and Decision**

# Introduction

The following email discussion has been triggered after RAN2#116bie-e:

* [POST116bis-e][510][Sdata] UP open issues (Huawei)

Scope:

- List of critical open issues to be resolved for WI completion

- Updated CR 38.321 for information and review

NOTE: NO contributions on these critical open issues are expected

Deadline:

- Open issues list Jan. 28th

- Company inputs Feb. 15th

Under the scope of the above email discussion, this questionnaire intends to address the open key issues for the user plane of SDT.

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# Remaining CG-SDT issues

Remaining TA issues for CG-SDT

It is possible that RA can be triggered during CG-SDT, e.g., no uplink grant or no SSB above the RSRP threshold. When RACH is triggered, agreements during the RAN2#116e meeting show that legacy TAT should be reused for the TA received during the RACH procedure.

* The legacy TAT (i.e. timeAlignmentTimerCommon in SIB) is used for UL timing maintenance during RA-SDT procedure. (21/23)
* The legacy TAT (i.e. timeAlignmentTimerCommon in SIB) starts/restarts when RAR TAC or TAC MAC CE is received, regardless of SDT procedure. No spec change is needed. (23/23)
* CG-SDT resource is not released even if the legacy TAT expires. (23/23)

For RA triggered during CONNECTED mode or during PUR, there are currently two models for the TA handling

***Model1: TA is ignored***

According to the current MAC spec, the TA handling in case of RACH procedure has been captured as follows:

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| The MAC entity shall:  1> when a Timing Advance Command MAC CE is received, and if an NTA (as defined in TS 38.211 [8]) has been maintained with the indicated TAG:  2> apply the Timing Advance Command for the indicated TAG;  2> start or restart the *timeAlignmentTimer* associated with the indicated TAG.  1> when a Timing Advance Command is received in a Random Access Response message for a Serving Cell belonging to a TAG or in a MSGB for an SpCell:  2> if the Random Access Preamble was not selected by the MAC entity among the contention-based Random Access Preamble:  3> apply the Timing Advance Command for this TAG;  3> start or restart the *timeAlignmentTimer* associated with this TAG.  2> else if the *timeAlignmentTimer* associated with this TAG is not running:  3> apply the Timing Advance Command for this TAG;  3> start the *timeAlignmentTimer* associated with this TAG;  3> when the Contention Resolution is considered not successful as described in clause 5.1.5; or  3> when the Contention Resolution is considered successful for SI request as described in clause 5.1.5, after transmitting HARQ feedback for MAC PDU including UE Contention Resolution Identity MAC CE:  4> stop *timeAlignmentTimer* associated with this TAG.  2> else:  3> ignore the received Timing Advance Command. |

In case of CBRA triggered during RRC\_CONNECTED with legacy TAT still running, the TA command in the RAR should be ignored by going to the branch with yellow.

***Model2: TA is processed***

In the legacy PUR spec in LTE, the following has been captured:

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| - upon considering a Random Access procedure successfully completed:   * start or restart the *pur-TimeAlignmentTimer*, if configured; * indicate to upper layers that the Timing Advance value has been adjusted; * if a temporary NTA has been stored, delete the stored temporary NTA.   - upon considering a Random Access procedure unsuccessfully completed, if a temporary NTA has been stored:   * set the NTA to the stored temporary NTA; * delete the stored temporary NTA. |

While during the email discussion after RAN2#116e, whether to adopt another NTA similar to PUR has been discussed. While, for the email discussion, the majority of the companies think that there should only be a single NTA. And we have the agreements during the RAN2#116bis meeting:

**Agreements:**

2 No additional NTA is defined for CG-SDT procedure

During the offline discussion for user plane, the following agreement has been made for the legacy TAT and CG-SDT-TAT and more generally the TA handling during CG-SDT:

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| 1. The CG-SDT-TAT does not stop at initiation of CG-SDT procedure 2. The CG-SDT-TAT does not stop at initiation of RA-SDT procedure 3. The CG-SDT-TAT does not stop at initiation of legacy RA procedure 4. If contention resolution fails during RA procedure (for both legacy RA and RA-SDT), the UE restores the NTA value used before RAR TAC is received 5. FFS and leave it to rapporteur If RAR TAC is received during RA-SDT procedure, the CG-SDT-TAT restarts at successful contention resolution 6. FFS and leave it to rapporteur If RAR TAC is received during legacy RA procedure, the CG-SDT-TAT restarts at successful contention resolution 7. FFS for SRBs, whether to discard PDCP SDUs upon reception of RRCRelease message including suspendConfig |

Based on the agreement above, it seems that we are heading towards the direction of model2 for TA handling.

### CG-SDT-TAT

It is possible that RA-SDT is triggering when CG-SDT is configured and *cg-SDT-TAT* is running, i.e., at initial SDT type selection, when selection of CG-SDT fails, the UE can select RA-SDT. It should be discussed when the intial RA-SDT procedure is successful and contention resolution passes, how the UE should handle the *cg-SDT-TAT*. From the understanding of the moderator, since the RA-SDT has been selected and there is no chance for the UE to use the CG-SDT anymore, the UE should consider this *cg-SDT-TAT* as expired, hence release the CG-SDT resource. This has already been implemented in the draft running CR accompanied to this email discussion

The issue is whether the UE should restart the *cg-SDT-TAT* when contention resolution is successful or when ACK is sent for the msg4/msgB for the contention resolution. The thinking from the moderator is the since both the UE and the network side would maintain an instance of the timer, the UE should only consider the time as expired when ACK is sent to the network, such that synchronization can be maintained between the UE and the network.

###### Question1: Do companies agree that when contention resolution is successful for RA-SDT and HARQ feedback is sent for msg4/msgB, the UE should consider CG-SDT-TAT as expired?

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| **Company** | **Yes/No** | **Comments** |
| LGE | No | We don’t want to introduce another trigger for CG-SDT-TAT expiry. The majority view in previous e-mail discussion [AT116bis-e][501] P17.1 and P17.2 was that the UE restarts the CG-SDT-TAT at successful contention resolution. We don’t see any problem to follow the majority view. |
| ASUSTeK | No | After completion of RA-SDT, the UE could initiate another SDT procedure if there are SDT data availiable later in RRC inactive state. Since the TA is still valid after contention resolution of RA-SDT, the CG-SDT-TAT should not be considered as expired. |
| Ericsson | Yes | If we initiate RA-SDT, once CR is successful, the CG-SDT resources should not be used so one straightforward handling of the timer is to see the CG-SDT-TAT as expired. Tying the trigger to ACK seems ok. W.r.t restarting the timer as discussed previously, we do not have a strong opinion here as long as one have the timer status in sync also in NW vs UE. |
| Samsung | No | Same view as LGE |
| CATT | No | Same view as LG. |
| Huawei, HiSIlicon | Yes | The discussion point here is whether the UE should stop the timer when HARQ feedback is sent to the network. We think the UE should stop the timer after HARQfeedback is sent since both the UE and the network need to maintain the timer. |
| NEC | No | Since delta SDT configuration in RRCRelease is supported, the CG-SDT resource can be maintained even RA-SDT is selected. Therefore, there is no need to consider CG-SDT-TAT as expired to deleate the CG resource. |
| Xiaomi | No |  |
| Nokia | Yes but | We can just release the CG-SDT resources in this case as they cannot be anyway used until next RRCRelease has been received. The CG-SDT-TAT plays no role after the point of RA-SDT initiation, hence, the resources can be released and CG-SDT-TAT stopped after the point the RA-SDT has been initiated. |
| Lenovo | Yes | In our understanding UE should not use the CG-SDT resources when RACH-SDT is performed (Contention resolution is successful). Regarding Asustek comment, NW can start the CG-SDT timer with RRCRelease message at the end of the RACH-SDT session. |
| InterDigital | No | Agree with LG. UE restars the timer upon successful contention resolution for a new TAC received in RAR. We don’t think the UE should release the CG at that point. |
| Apple | No | Same view as LGE. |
| OPPO | No | Since we have agreed to support delta config for CG-SDT resources, this release behaviour may make it impossible once RA-SDT is triggered. |
| Intel | No | We agree that CG-SDT-TAT should not be considered as expired as this would imply the release of the CG-SDT configuration (based on current running CR to 38.321). This is not preferable considering the delta operation as discussed in R2-2202674. If the timer is kept running, the specification would need to handle what UE does when/if CG-SDT-TAT expires during an RA-SDT session (assument that UE has a valid CG-SDT configuration). Therefore for simplicity, we understand that upon successful initiation of RA-SDT proc, the CG-SDT-TAT is stopped (but the stored CG-SDT configuration is still maintained). Alternatively, if it is preferable to maintain the CG-SDT-TAT running during an RA-SDT session and it expires, the related CG-SDT configuration should not be released. This is not necessary as gNB can update any of the required values when sending the RRCRelease msg at the end of the ongoing SDT session.  Another related topic that needs discussion is whether CG-SDT resources can be used during RA-SDT session. Our preference is that CG-SDT resources are not used when an RA-SDT session is ongoing. |
| vivo | No | As there is an ongoing RA-SDT procedure with legacy TAT running, then the CG-SDT-TAT can be stopped, but not considered as expiry. If RRC release message with CG-SDT resource is received then, the UE would restart the CG-SDT-TAT. |
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###### Final WF:

### LegacyTAT

Another question is for the legacy TAT. When legacy RACH or RA-SDT is triggered, legacy TAT will be started after reception of RAR/msgB. But with CG-SDT-TAT maintaining the TA, it seems that there is no need for another timer, i.e., legacy TAT to maintain another TAT. In the legacy spec, we had the following example for stopping TAT after successful contention resolution for on-demand SI request:

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| 2> else if the *timeAlignmentTimer* associated with this TAG is not running:  3> apply the Timing Advance Command for this TAG;  3> start the *timeAlignmentTimer* associated with this TAG;  3> when the Contention Resolution is considered not successful as described in clause 5.1.5; or  3> when the Contention Resolution is considered successful for SI request as described in clause 5.1.5, after transmitting HARQ feedback for MAC PDU including UE Contention Resolution Identity MAC CE:  4> stop *timeAlignmentTimer* associated with this TAG. |

With the above, we ask the following question

###### Quesiton2: Do companies agree that when contention resolution is successful for legacyRA triggered when CG-SDT-TAT is running, the UE stops legacy TAT after successful contention resolution and uplink transmission has been performed?

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| **Company** | **Yes/No** | **Comments** |
| LGE | No | The highlighted text is only for SI request, and not related to the legacy RA procedure. The legacy behavior is to stop the legacy TAT at unsuccessful contention resolution (the text above the highlighted one). If contention resolution is successful, the UE shall keep the legacy TAT running, same as legacy. |
| ASUSTeK | No | No additional behavior is introduced to legacy TAT. After the UE triggers a legacy RA, it may transit to RRC connected state. |
| Ericsson | Yes, comment | If the TAT is left running and expires during CG-SDT procedure, the UE will flush HARQ etc and this is not the wanted behaviour. To not impact legacy TAT handling, another condition would be needed which seems to add a larger complexity in this case.  One could also consider that CG-SDT-TAT is restarted after CR to avoid that this expires. |
| Samsung | No | Same view as LGE |
| CATT | No, but | It was agreed that “The legacy TAT (i.e. timeAlignmentTimerCommon in SIB) starts/restarts when RAR TAC or TAC MAC CE is received, regardless of SDT procedure.” If the contention resolution is successful for legacy RA triggered when CG-SDT-TAT is running and the UE is **NOT** indicated to go to RRC CONNECTED, the legacy TAT can be stopped. |
| Huawei, HiSIlicon | Yes | Same view as E//. Better to stop the timer to avoid HARQ buffer flushing according to the current spec |
| NEC | No | The highlighted text is only for SI request, and not related to the legacy RA procedure. |
| Xiaomi | No |  |
| Nokia | No | We can keep the legacy TAT as is – actually, we still prefer to only use legacy TAT to maintain the UL timing during SDT procedure. |
| Lenovo | Yes/No | In general think that only one TA timer is required in order to maintain the uplink timing. For example if CG-SDT TAT is running and UE is considered as uplink synchronized there is no need that legacy TAT is also running. However in this case UE should restart the CG-SDT TAT upon reception of TAC when CR is successful. |
| InterDigital | No | Legacy TAT can be kept as is. |
| Apple | Yes | Same view as Ericsson, and UE should restart the CG-SDT-TAT after the contention resolution. |
| OPPO | No | We also think one timer is enough to maintain TA in this case. But in order to make the mechanism of TA timers simple, we prefer not to introduce new stop events for legacy TAT. |
| Intel | No | We prefer that same behaviour of legacy TAT applies regardless/independently of whether CG-SDT-TAT timer is or not running. |
| vivo | No | The legacy timer can be used. We only need to focus on the CG-SDT-TAT operation. |
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###### Final WF:

### Reference RSRP

During the last R2 meeting, we have agreed that the stored RSRP at the initial CG-SDT transmission for RSRP-based TA validation shall be the downlink RSRP when RRCRelease message was received.

However, at the time of the reception of the RRCRelease message, the UE is still in the RRC\_CONNECTED mode and have multiple SSB burst to measure according to the measurement object configuration. It should be further determined how the downlink RSRP is determined at this time.

###### Question3: Do companies agree that downlink RSRP reference at the time of receiving RRCRelease with suependConfig for the RSRP-based TA validation is determined by the MO for the cell where the UE is released?

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| **Company** | **Yes/No** | **Comments** |
| LGE | Yes |  |
| ASUSTeK | Yes |  |
| Ericsson | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| NEC | Yes |  |
| Xiaomi | Yes |  |
| Nokia | Unclear | It is not clear what is meant by the question. |
| Lenovo | Yes |  |
| InterDigital | Yes |  |
| Apple | See comments | MO based RSRP measurement is just for the CONNECTED UE, and can be used for the CONNECTED UE receives the RRCRelease with the SDT configuration.  But if the SDT UE receives the RRCRelease with the SDT configuration during the ongoing SDT session (to end the current SDT), there is no MO based RSRP measurement in SDT period. And some clarification is needed. |
| OPPO | Yes |  |
| Intel | Yes |  |
| vivo | No | It shall be done based on the configuration in RRC Release message rather than the MO configuration for Connected UE. |
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###### Final WF:

## Frequent RACH triggered for SSB reselection

At RAN2 #115e meeting, RAN2 also agreed that UE can initiates legacy RACH procedure if no qualified CG-SSBs are available.

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| 1. During subsequent CG transmission phase (i.e. after the UE has received response from NW) UE can initiate at least legacy RACH procedure (e.g. trigger due to no UL resources).  No MAC PDU rebuilding is required.  FFS if the RA-SDT RA resources can be used for subsequent data.   a.   At least the following conditions are agreed: (1) no qualified SSB when the evaluation is performed; (2) when TA is invalid; (3) when SR is triggered due to lack of UL resource |

However, if UE triggers legacy RACH procedure every time there are no qualified CG-SSBs, it leads to frequently triggered legacy RACH.



When UE triggers legacy RACH procedure, an SSB is selected according to the SSB selection rule of legacy RACH. If the procedure is successfully completed, it means that the SS-RSRP of the SSB selected in legacy RACH is high enough. Also, the network is informed implicitly via RACH procedure of the new SSB it should use to communicate with the UE. Hence, during the following new transmissions, even though UE has no qualified CG-SSBs, the SSB selected in legacy RACH can be re-used if it is qualified (i.e. SS-RSRP of this SSB is above *rsrp-ThresholdSSB*), without having to trigger another legacy RACH.

###### Quesiton4: Do companies agree that UE should trigger legacy RACH during CG-SDT when there are no qualified CG-SSBs available and the SSB selected in the previous legacy RACH is not qualified for RACH SSB selection?

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| **Company** | **Yes/No** | **Comments** |
| LGE | No | The previous RA procedure may be long time ago, and the SSB selected in the previous RA procedure may not be suitable for current CG-SDT transmission. We think the issue3 is not an open issue. |
| ASUSTeK | No | Agree with LG. |
| Ericsson | Yes |  |
| Samsung | No | Agree with LGE  Also note that there may or may not be any CG for SSB selected during previous RA |
| CATT | No | Agree with LGE |
| Huawei, HiSilicon | Yes |  |
| NEC | No | We don’t think using the SSB selected in legacy RACH for CG transmission if it is qualified is a good idea. The mapping relation of SSB and CG resource will be changed and hard to be managed by the network. |
| Xiaomi | No |  |
| Nokia | No | RAN4 eventually defines the requirements to determine the qualified SSBs. It is not clear there would be frequent RA triggers based on the “no qualified SSB available” requirement. |
| Lenovo | No |  |
| InterDigital | No |  |
| Apple | No | Agree with LGE. |
| OPPO | No | Agrew with LGE. |
| Intel | No |  |
| vivo | No | The UE can just skip this transmission occasion and perform the transmission until a qualified SSB is available. |
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###### Final WF:

## Initial CG-SDT acknowledgement

For CBRA triggered during RRC\_CONNECTED, after the msg3 is transmitted, contention resolution is considered as successful when PDCCH addressed to C-RNTI is received for scheduling uplink new transmission. While here, the uplink new transmission can be for any HARQ process. This uplink new transmission is used for acknowledgement of the msg3 in the uplink.

For CG-SDT, we have a similar scenario for initial CG-SDT transmission. We need to ask the same question whether uplink grant after initial CG-SDT transmission for any HARQ process can serve as acknowledgement for initial CG-SDT transmission

###### Quesiton5: Do companies agree that dynamic uplink grant for HARQ process different from the one used for initial CG-SDT transmission can serve as acknowledgement for initial CG-SDT transmission?

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| **Company** | **Yes/No** | **Comments** |
| LGE | No | We don’t understand why the network provides UL grant for other HARQ process. Moreover, we don’t want to associate different HARQ processes for transmission/feedback. |
| ASUSTeK | No | Stick to agreement in the last meeting. |
| Ericsson | Yes, comment | The use-case for this is somewhat unclear; maybe there is a latency gain in scheduling in some cases. In any case we think that if the grant is used for subsequent transmissions (e.g. initial tx contained BSR) then any HARQ process would do (CG timer running) as ack. |
| Samsung | Yes | Dynamic UL grant is for new transmission. It can be for any HARQ process. No reason to our any restriction. |
| CATT | Yes | We don’t see any issues that dynamic uplink grant for HARQ process different from the one used for initial CG-SDT transmission as acknowledgement for initial CG-SDT transmission. And it is more flexible. |
| Huawei, HiSIlicon | Yes | There is no previous agreement that the dynamic scheduling after CG-SDT transmission has to have the same HARQ process id as the initial CG transmission. If the network schedules UL grant for a new HARQ process, we think it can also serve as ACK.  This is exactly the same as conteitnion resolution for RACH in connected |
| NEC | No | We think following the legacy behaviour for CG transmission acknologement is sufficient. |
| Xiaomi | No strong view | Maybe it would be simpler for the UE implementation to use the same HARQ process. |
| Nokia | Unclear | It serves similarly as NW response for the initial transmission but ACK happens only with new UL tx for the same HARQ process.  The cases of NW response and acknowledgement should hence be separated. |
| Lenovo | No | Don’t see a specific need for this. We could have similar behvaiour as for BFR MAC CE, where initial uplink grant for the HARQ process used for the transmission of the BFR MAC CE is considered as some acknowledgement. |
| InterDigital | No | We already agreed that “Support ACK for first TB by dynamic scheduling of uplink new transmission for the same HARQ process (like legacy, no new mechanisms).”  This is enough, and no reason to deviate from the agreement. |
| Apple | No | It can work regardless whether NW response via the different or same HARQ process. But from UE perspective, the same HARQ process could be easy UE implmenetation. |
| OPPO | Yes |  |
| Intel | No | We understand that Rel-15/16 behavior in non NR-U scenarios is sufficient to know whether 1st UL CG SDT is successfully received by the network (which is aligned to previous RAN2 agreement).  - For a CG transmission, if C-RNTI is received for the same HARQ process, then UE considers NDI to be toggled (which could be considered as “ACK”).  - For a CG transmission, if CS-RNTI is received for the same HARQ process with NDI=1, then UE considers NDI not toggled (this can be considered as “NACK”).  On summary, we do not see the need to add additional functionality for CG-SDT (i.e. ACK based on dynamic UL grant received for a different HARQ process) |
| vivo | No | Acknowledgment should be done based on the same HPID. |
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###### Final WF:

## MAC reset

At current MAC reset procedure, the following will be performed:

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| 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*.  If a Sidelink specific reset of the MAC entity is requested for a PC5-RRC connection by upper layers, the MAC entity shall:  1> flush the soft buffers for all Sidelink processes for all TB(s) associated to the PC5-RRC connection;  1> consider all Sidelink processes for all TB(s) associated to the PC5-RRC connection as unoccupied;  1> cancel, if any, triggered Scheduling Request procedure only associated to the PC5-RRC connection;  1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure only associated to the PC5-RRC connection;  1> cancel, if any, triggered Sidelink CSI Reporting procedure associated to the PC5-RRC connection;  1> stop (if running) all timers associated to the PC5-RRC connection;  1> reset the *numConsecutiveDTX* associated to the PC5-RRC connection;  1> initialize *SBj* for each logical channel associated to the PC5-RRC connection to zero. |

The question is whether we should also consider *cg-SDT-TimeAlignmentTimer* to be expired at MAC reset, similar to the legacy TAT and perform the procedure when TA expries in clause 5.2 of TS 38.321, i.e., release CG-SDT resource, clear HARQ buffer, etc.

Note that in the previous meeting, we have agreed that we should allow for delta configuration for small data configuration. While here, if we consider cg-SDT-TimeAlignmentTimer to be expired at MAC reset, the CG-SDT configuraiotn will be cleared immediately and there cannot be delta configuration between different CG configurations of different CG-SDT procedures.

###### Quesiton6: Do companies agree to consider cg-SDT-TimeAlignmentTimer to be expired and perform the procedure in 5.2 (Maintenance of uplink time alignment) at MAC reset?

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| **Company** | **Yes/No** | **Comments** |
| LGE | Yes |  |
| ASUSTeK | No | Similar to LTE, when the UE receives RRCRelease message, the UE would apply the CG-SDT configuration then reset MAC. The CG-SDT TAT should not be expired at MAC reset. |
| Ericsson | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Huawei, HiSIlicon | Yes | The UE resets MAC first and then apply the configuration  2> reset MAC and release the default MAC Cell Group configuration, if any;  2> re-establish RLC entities for SRB1;  2> if the *RRCRelease* message with *suspendConfig* was received in response to an *RRCResumeRequest* or an *RRCResumeRequest1*:  3> stop the timer T319 if running;  3> in the stored UE Inactive AS context:  4> replace the KgNB and KRRCint keys with the current KgNB and KRRCint keys;  4> replace the C-RNTI with the C-RNTI used in the cell (see TS 38.321 [3]) the UE has received the *RRCRelease* message;  4> replace the *cellIdentity* with the *cellIdentity* of the cell the UE has received the *RRCRelease* message;  4> replace the physical cell identitywith the physical cell identity of the cell the UE has received the *RRCRelease* message; |
| NEC | No | According to the running CRs, upon reception of RRCRelease, the UE applies the suspendConfig first, which includes SDT configuration. And the MAC layer starts the cg-SDT-TimeAlignmentTimer upon reception of the configuration. Then the UE performs MAC reset. If the cg-SDT-TimeAlignmentTime is considered as expiry, this would end up in CG-SDT not being able to be trigged at all.  Also this is the same as LTE PUR. |
| Xiaomi | Yes | Agree with Huawei. |
| Nokia | Yes | The new cg-SDT-TAT should only start after MAC reset. |
| Lenovo | Yes |  |
| InterDigital | Yes |  |
| Apple | Yes, but.. | It requires UE to perform MAC reset first and then apply the CG-SDT configuration. And the RRC CR needs to be updated according to this logic. |
| OPPO | Yes, but | MAC is also reset when RRCReject is received, further discussion may needed for this case. |
| Intel | No | CG-SDT configuration will be provided using delta (as it is being discussed in CP email discussion and 38.331 running CR). If CG-SDT-TAT is considered expired during MAC reset, this means that UE releases the CG-SDT configuration (based on current 38.321 running CR). This is not desirable understanding that MAC release is performed in every *RRCRelease* procedure (i.e. every time the SDT session is terminated).. |
| vivo | Yes |  |
|  |  |  |

###### Final WF:

Autonomous CG retranmission

In the previous R2 meeting, we have agreed that autonomous retransmission on CG can be supported for initial CG-SDT transmission. However, one issue remains for the RV of the autonomous CG retransmission. For repetition in R15, the RV for CG is fixed according to the *configuredGrantConfig*.

|  |
| --- |
| ConfiguredGrantConfig ::= SEQUENCE {  frequencyHopping ENUMERATED {intraSlot, interSlot} OPTIONAL, -- Need S  cg-DMRS-Configuration DMRS-UplinkConfig,  mcs-Table ENUMERATED {qam256, qam64LowSE} OPTIONAL, -- Need S  mcs-TableTransformPrecoder ENUMERATED {qam256, qam64LowSE} OPTIONAL, -- Need S  uci-OnPUSCH SetupRelease { CG-UCI-OnPUSCH } OPTIONAL, -- Need M  resourceAllocation ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch },  rbg-Size ENUMERATED {config2} OPTIONAL, -- Need S  powerControlLoopToUse ENUMERATED {n0, n1},  p0-PUSCH-Alpha P0-PUSCH-AlphaSetId,  transformPrecoder ENUMERATED {enabled, disabled} OPTIONAL, -- Need S  nrofHARQ-Processes INTEGER(1..16),  repK ENUMERATED {n1, n2, n4, n8},  repK-RV ENUMERATED {s1-0231, s2-0303, s3-0000} OPTIONAL, -- Need R |

We thus ask the following question:

###### Question7: Do companies agree that RV of the autonomous retransmission for initial CG-SDT transmission can be configured by RRC with the current field repK-RV?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| LGE | No | It would be simple to fix the RV value, e.g. 0, for every autonomous retransmission for initial CG-SDT transmission. |
| ASUSTeK | Yes |  |
| Ericsson | No | Since autonomous transmissions are only performed in case the NW has not detected the transmission, there is on reason to change RV. |
| Samsung | No | Agree with views from LGE and Ericsson |
| CATT | Yes, but | In Rel-16, when *cg-RetransmissionTimer* is configured, i.e. in NR-U, RV value is determined by the UE. And when *cg-RetransmissionTimer* is not configured, the UE can apply the value configured in RRC if configured. Otherwise, it is specified in PHY spec. From our understanding, we can reuse the same principle. |
| Huawei, HiSilicon | Yes | Change RV is beneficial for soft combining. Autonomous transmission is not only for the network not detecting the transmission, but for wrong reception, it is also beneficial if the network can do soft combining.  Actually, the exact intention to keep the HARQprocess to be the same is for soft combining. Otherwise, the initial retrnasmision can use a different HARQ process |
| NEC | No | Prefer to fix RV value as 0. |
| Xiaomi | No | Prefer RV0 as the Gnb may not be able to detect the first transmission. |
| Nokia | No | Agree with LGE. NW does not know when the initial transmission happens and hence the RV should not change. |
| Lenovo | No | Simple solution should be used. There is no point in configuring a specific RV sequence. |
| InterDigital | No | Agree with Ericsson. This similar logic to retransmitting MsgA using the same RV in case no response was received from the network. |
| Apple | No | The RV value should be not changed and fix to 0. |
| OPPO | No | Agree with LGE. |
| Intel | See comment | We suggest waiting for input from RAN1 on the repK-RV as it is under discussion by them. |
| vivo | No | RAN1 input is needed first. |
|  |  |  |

###### Final WF:

# Remaining common UP issues

## Carrier selection for SDT

Furthermore, there is a parameter called *sdt-RSRP-ThresholdSSB-SUL,* used for UL carrier selection for SDTand the following editor’s NOTE has been captured.

|  |
| --- |
| Editor’s Note: FFS whether the RSRP threshold for UL carrier selection is common for both CG and RA-SDT. |

For RA-SDT, such parameter might not be needed if it is eventually agreed to perform RACH partition selection before carrier selection as, in such case, the SDT specific threshold (or feature combination specific threshold in general) can be configured in RACH configuration as in legacy case. However, we think sdt-RSRP-ThresholdSSB-SUL parameter should still be kept for the sake of choosing a carrier for CG-SDT. For CG-SDT carrier selection, it is not possible to use the threshold signalled in RACH configuration as RACH is not used in case the conditions for performing CG-SDT are met.

###### Question8 Do companies agree that sdt-RSRP-ThresholdSSB-SUL used in MAC for uplink carrier selection can be separate between RA-SDT and CG-SDT?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| LGE | No | We think common threshold is enough. Moreover, we think feature-specific RSRP threshold should not be used, i.e. common threshold *rsrp-ThresholdSSB-SUL* should be used for carrier selection regardless of feature. This issue should be discussed in the RACH partitioning discussion. |
| ASUSTeK | No | Common threshold is enough. |
| Ericsson | No | This can be rediscussed when the order of procedures have been confirmed. The RSRP is not very dependent on how the UE initiated the UL TX (RA or CG). |
| Samsung | No |  |
| CATT | - | We think we can wait for the progress in RIP to decide whether to revert the agreement that *sdt-RSRP-ThresholdSSB-SUL* is defined for SDT. If the previous agreement is not reverted, we think it is not necessary to define one separate threshold between RA-SDT and CG-SDT. |
| Huawei, HiSilicon | Yes | The sdt-RSRP-ThresholdSSB-SUL for RA-SDT and CG-SDT are configured in system information and dedicated configuration, respectively. There is no need to restrict the thresholds to be the same. |
| NEC | No | We think common threshold is sufficient. |
| Xiaomi | No |  |
| Nokia | No | Simplest to use the same. |
| Lenovo | No | We think that a common threshold is sufficient. RSRP threshold should not depend on whether UE performs RACH based SDT or CG-SDT. |
| InterDigital | No |  |
| Apple | No |  |
| OPPO | No |  |
| Intel | No | We understand that a single value for RA-SDT and CG-SDT is sufficient understanding that UL carrier selection is performed before. Note that this question is inter-related to issue Z025 of CP email discussion. |
| vivo | No | As UL carrier selection is performed before CG-SDT selection, only one common threshold is feasible. |
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###### Final WF:

RB handling

During RAN2#116bis, the following agreements have been achieved for SRB and DRB during SDT initiation

Agreements

1. For both DRBs and SRBs configured with SDT, RAN2 confirm that at the time of SDT data volume calculation, there should be no buffered packets in PDCP/RLC entities that will not be transmitted during SDT procedure
2. For DRBs configured with SDT, PDCP suspend is performed upon reception of RRCRelease message including suspendConfig so that PDCP PDUs are discarded, and PDCP SDUs already stored are considered in SDT data volume calculation. No specification change is needed.
3. For both DRBs and SRBs configured with SDT, RLC entity should be re-established upon reception of RRCRelease message including suspendConfig
4. For both DRBs and SRBs configured with SDT, the UE autonomously re-establishes RLC entities for both DRBs and SRBs upon reception of RRCRelease message including suspendConfig

And the following issue has been marked as FFS

1. FFS for SRBs, whether to discard PDCP SDUs upon reception of RRCRelease message including suspendConfig

During the offline email discussion during R2#116bis-e, it has been pointed out by ZTE that the following has been captured for the PDCP entity during SDT intiation:

|  |
| --- |
| 1. re-establish PDCP entities for SRB1; 2. resume SRB1; 3. if the resume procedure is initiated for SDT:   2> for each radio bearer that is configured for SDT:  3> re-establish PDCP entity for the radio bearer without triggering PDCP status report;  2> resume all the radio bearers that are configured for SDT;  Legacy behaviour  Added for SDT |

Hence, it is clear that if the text highlighte in yellow is captured, the PDCP entities will be re-established and for PDCP configured for SRBs, PDCP SDUs will be discarded. Hence, no special treatment of the PDCP SRB SDUs are needed.

Based on the above, we ask the following question:

###### Question9: Do companies agree that for SRBs, PDCP SDUs do not need to be discarded upon reception of RRCRelease message including suspendConfig?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| LGE | Yes for SRB1.  No for SRB2 | The issue is whether the PDCP SDUs should be discarded for SRB2, which is not covered by the above highlighted text. |
| Ericsson | Yes |  |
| Samsung | See comment | Agree with LGE.  When SDT procedure is initiated, PDCP SDUs for SRBs are discarded during the PDCP entity re-establishment procedure. If SRB 2 is configured as SDT RB, the old PDCP SDUs of SRB 2 should not be used in SDT data volume calculation. In order for these old PDCP SDUs of SRB2 to be not counted in SDT data volume calculation, it would be simple to re-establish PDCP entity of SRB 2 (if configured as SDT RB) upon receiving RRC Release with suspend configuration. |
| CATT | Yes for SRB1 | The PDCP entity for SRB2 will not re-established. One simple solution is to follow DRB, i.e. SRB2 PDCP PDUs will be discarded and PDCP SDUs already stored are considered in SDT data volume calculation on the condition that SRB2 is configured using SDT. |
| Huawei, HiSIlicon | No | When PDCP is re-establsihed, all SRBs are discarded. This is applicable for both SRB1 and SRB2 |
| NEC | No (i.e. PDCP SDUs need to be discarded upon reception of RRCRelease) | The logic of the issue is that since the PDCP SDUs and PDUs of SRB are discarded after SDT is triggered, they should not be counted into SDT data volume calculation. Therefore, PDCP SDU discard for SRB should be performed before SDT data volume calucation. And the same as the buffer data in RLC entity, it can be performed upon RRC release.  The text highlighted by the rapporteur is to discard buffered data after SDT is triggered, which cannot solve the problem.  Additionaly, since it was agreed in the last meeting that SRB1 is not configured with SDT, we agree with LG that PDCP SDU discard upon RRC Release is only needed for SRB2. |
| Xiaomi | No | It would be simpler to discard all PDCP PDUs for both SRB1 and SRB2. |
| Nokia | Yes |  |
| Lenovo | Yes |  |
| InterDigital | Yes |  |
| Apple | See comments | Current running CR is sufficient on the PDCP SDU handling for SRBs.  In the running CR, PDCP will be reestablished (including discarding the PDCP SDU) for all the SDT-DRB and SDT-SRBs when initiating the SDT procedure. |
| OPPO | No | Agree with NEC. |
| Intel | Yes for SRB1  No for SRB2 | We suggest leaving the handling up to UE implementation understanding that any required NAS/AS interaction seems to also be left up to UE implementation during an SDT session. Note that this question is inter-related to issue Z023 of CP email discussion. |
| vivo | No | We prefer to use the same principle for both SDT-DRB and SDT-SRB.  *For DRBs configured with SDT, PDCP suspend is performed upon reception of RRCRelease message including suspendConfig so that PDCP PDUs are discarded, and PDCP SDUs already stored are considered in SDT data volume calculation. No specification change is needed.* |
|  |  |  |

###### Final WF:

# RA-SDT

UE should be allowed switch from either 4-step or 2-step RA-SDT to normal RACH to perform legacy RRC resume procedure if number of preamble transmission of RA-SDT achieves a threshold. This issue was discussed in [AT115e][502] in RAN2 #115e and FFS. We do see the benefit if allowing UE switching to legacy resume/RACH first and then transmit data in connected state. Otherwise, UE has to go to idle by decalring SDT failure, which is not efficient.

From the point of the view from the Rapp, this should not be feasible from the MAC layer’s perspective. The MAC layer should send indication to the RRC layer that RA-SDT has failed and then RRC layer triggers legacy RRCResume

###### Question10: Do companies agree what when the maximum number of RA-SDT transmission exceeds the threshold preambleTransMax, the UE stops the RA-SDT procedure and indicates to higher layer RA-SDT failure to trigger legacy RACH?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| LGE | No | We think that when the preambleTransMax is reached, the UE stops the RA-SDT procedure and indicates to RRC to trigger SDT failure procedure. However, legacy RA procedure is not triggered by SDT failure procedure but by the presence of UL data after the SDT failure procedure. We don’t want to associate two different procedures, i.e. SDT failure procedure and legacy RA procedure. |
| ASUSTeK | Yes | Instead of repeating the failed initial UL transmission in RA-SDT and going into idle mode, the UE could resume to connected mode by a legacy RA and then transmit UL data in connected mode. |
| Ericsson | No | Agree with LG, i.e. the trigger from RA-SDT failure itself should not be linked to initiating legacy RACH. |
| Samsung | No | As in legacy, in RRC INACTIVE, when preambleTransMax is reached, MAC enitity indicates to RRC that max preamble transmission is reached and continue RA procedure. In RRC\_INACTIVE/RRC IDLE, no action is taken by RRC in this case. Timer expiry in RRC triggers subsequent action.  Same behaviour can be applied for SDT. UE continue RACH when preambleTransMax is reached. SDT failure handling is triggered by SDT timer expiry, |
| CATT | No | We have the same view that the UE should indicate RRC when RA-SDT failure happens. |
| Hauwei, HiSIlicon | NO | Should trigger SDT failure. |
| NEC | No | We don’t support swtich from RA-SDT to non-SDT. The failure/stop of RA-SDT procedure should be controlled by the T319-like timer. It is not reasonable to swtich to non-SDT while T319-like timer is still running. So if the MAC layer indicate RA failure to RRC layer, the RRC layer can trigger MAC to perform a second round SDT, however this is up to UE implementation. |
| Xiaomi | No | The UE should trigger SDT failure. |
| Nokia |  | Should be handled similarly to other failure cases. |
| Lenovo | No | Agree with LG |
| InterDigital | No | No need to differentiate this failure case. |
| Apple | No | We should follow the same behavior as legacy, i.e. MAC indicates the the RACH failure to RRC when the preamble transmission reaches the max number and continue the RACH procedure. |
| OPPO | No | Follow legacy behaviour. |
| Intel | See comment | Our preference is to allow the UE to stay in RRC\_INACTIVE in orde to trigger an independent/new resume. This allows the UE to continue getting the advantage of being in RRC\_INACTIVE with a valid UE AS Context. On this topic, we proposed the following in R2-2200506:  Proposal 2. Upon reaching preambleTransMax during RA-SDT procedure, UE is allowed to remain in RRC\_INACTIVE (i.e. instead of moving to RRC\_IDLE).  Proposal 2.1. Upon reaching preambleTransMax during 2-step RA-SDT procedure and 4 step RA-SDT is not configured, UE aborts the 2-step RA-SDT procedure but remains in RRC\_INACTIVE. I.e. UE is allowed to initiate a new/independent access attempt via legacy RACH (i.e. non-SDT) without having to define any new mechanism.  Proposal 2.2. Upon reaching preambleTransMax during 4-step RA-SDT procedure, UE aborts the 4-step RA-SDT procedure but remains in RRC\_INACTIVE. I.e. UE is allowed to initiate a new/independent access attempt via legacy RACH (i.e. non-SDT) without having to define any new mechanism.  Note that this topic is inter-related to issue X001 on CP email discussion |
| vivo | No | RA-SDT can be performed as long as the SDT failure detection timer is running. |
|  |  |  |

###### Final WF:

# Other issues

Companies are invited to provide other issues in this section

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Critical Issue | Proposed WF | Rapp WF |
| Xiaomi | According to our paper in R2-2201379, it is not clear from the current running CR which RSRP is used as the RSRP reference for TA validation. | The RSRP reference for TA validation of CG-SDT is:  From the same cell where the CG-SDT is configured.  The latest available RSRP when the RRCRelease message is received. (Already agreed in RAN2#116bis-e)  The RSRP of serving MO. | Added to the open issue list |
| Ericsson | The UE action upon expiry of the legacy -TAT may need clarification | If there is a case for when the legacy TAT is started during a RA procedure within an ongoing CG-SDT procedure that time out while the CG-SDT procedure is still active. Currently the UE may e.g. flush HARQ buffers and this may not be the wanted behaviour. | This is already being handled by issue WF for issue2. If we stop the time at successful contention resolution and uplink new transmission, there is no need to worry about this anymore |
| CATT | If *cg-SDT-Timer* expires, the UE will perform autonomous retransmission for the initial transmission.  However, if there is no restriction on the maximum number, the UE will perform retransmission again and again. | Solution 1: Introduce one maximum number/timer for the autonomous retransmison.  Solution 2: it is up to the network implementation to make sure that the UE can receive confirmation for the initial transmission from the network. | In the last meeting, R2 has already that CGT can be reused. Then, when CGT expires, the UE will assume an ACK for he uplink transmission and autonomous retransmission will stop. This is exactly like what we did in NRU.  CATT: We are wondering whether there is one case that the network does not receive anything from the UE for the initial transmission in CG-SDT and both *cg-SDT-RetransmissionTimer* and CGT expire. If this can happen, how to define the UE behavior. Because, it was agreed in RAN2#116e meeting that  9. The UE is allowed to initiate subsequent UL data transmission only after the reception of confirmation of initial transmission from the gNB  In this way, even CGT expires and the UE considers the transmission is successful, the UE can’t perform subsequent transmission. |
| CATT | The UE is not required to monitor PDCCH when *cg-SDT-Timer* expires. But this has retriction on the network scheduling especially there is no subsequent transmission. | Suggest the UE may monitor PDCCH when *cg-SDT-Timer* expires. | In the alst meeting, we have agreed that cg-SDT-Timer is only used for controlling the retransmission of the initial CG-SDT.  Actually, in the runningCR, the name of the timer has already been changed to *cg-SDT-RetransmissionTimer* |
| Qualcomm | UE is allowed switch from either 4-step or 2-step RA-SDT to normal RACH to perform legacy RRC resume procedure if number of preamble transmission of RA-SDT achieves a threshold | This issue was discussed in [AT115e][502] in RAN2 #115e and FFS. We do see the benefit if allowing UE switching to legacy resume/RACH first and then transmit data in connected state. Otherwise, UE has to go to idle by decalring SDT failure, which is not efficient. | Added to the open issue list.  From the point of the view from the Rapp, this should not be feasible from the MAC layer’s perspective. The MAC layer should send indication to the RRC layer that RA-SDT has failed and then RRC layer triggers legacy RRCResume |
| Samsung | While the CG-SDT procedure is ongoing, CG-SDT-TAT can expire. CG-SDT-TAT can expire before the UE has received any response after the initial UL packet transmission to gNB. In this case CG-SDT resources will be released and UE can not perform any retransmissions. | If CG-SDT-TAT expires while the CG-SDT procedure is ongoing and if UE has not received any response after the initial UL packet transmission to gNB, UE terminates ongoing SDT procedure. |  |
| Lenovo/Motorola Mobility | RAN2 should discuss whether UE in RRC\_INACTIVE configured with CG-SDT is required to maintain its uplink timing alignment as in RRC\_CONNECTED, i.e. UE in RRC\_INACTIVE (gradually) adjusts its uplink timing when there is a DL timing difference observed by the UE.  With the introduction of SDT, it actually makes also sense that UE maintains its uplink timing alignment in RRC\_INACTIVE, in particular for the case of CG-SDT. Since UE performs UL transmission, e.g. CG PUSCH, in RRC\_INACTIVE without a prior random access, it is beneficial for the timing accuracy if UE maintains its uplink timing alignment also in RRC\_INACTIVE when being configured with CG-SDT resources and a TAT timer, i.e. (gradually) adjusting its uplink timing when there is a DL timing difference observed by the UE, e.g. UE autonomously adjusts its uplink timing in order to follow the DL timing reference. | UE in RRC\_INACTIVE when being configured with CG-SDT resources maintains its uplink timing alignment, i.e. (gradually) adjusting its uplink timing when there is a DL timing difference observed by the UE, e.g. UE autonomously adjusts its uplink timing in order to follow the DL timing reference. |  |
| Apple | During the initial CG-SDT transmisison, whether should the UE release the CG-SDT resource immediately if the CG-SDT-TAT expires before receiving the NW response if the | Suggest UE waits for the NW response till the *cg-SDT-RetransmissionTimer* expiry.  If the NW response includes the TAC MAC CE, UE can restarts the CG-SDT-TAT; otherwise, UE releases the CG-SDT resource.  If UE cannot waits for the NW response, UE terminates the CG-SDT procedure. |  |
| Apple | During the subsequent SDT transmission period, whether should the UE release the CG-SDT resource immediately when the CG-SDT-TAT expires? | During the subsequent SDT transmission phasem UE should release the CG-SDT resource immediately upon the CG-SDT-TAT expiry, but SDT procedure is not impacted. |  |
| Apple | For the DL RSRP based TA validation mechanism, if UE receives the RRCRelease with CG-SDT configuration as the last NW message to terminate the ongoing SDT session, what’s the DL RSRP to be compared? | It depends on how UE performs the RRM measurement during the SDT procedure. |  |

# Conclusions

To be filled later

# References