**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.

# Contact Information

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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. |
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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. |
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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 |  |
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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. |
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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. |
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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. |
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###### 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*.

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| 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?

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| **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 |  |
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###### 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.

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| 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. |
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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:

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| 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. |
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###### 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?

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| **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. |
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###### Final WF:

# Other issues

Companies are invited to provide other issues in this section

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| 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 | 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 |

# Conclusions

To be filled later

# References