**3GPP TSG-RAN2#125 R2-24xxxxx**

**Athens, Greece, Feb. 26th – Mar. 1st, 2024**

**Source: ZTE Corporation(rapporteur)**

**Title: Report of [POST125][026][MT-SDT]: Harmonising the handling of *SDT ongoing* and *T319a***

**Agenda item:** **7.18.1**

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

# Introduction

This document is used to discuss the harmonisation of SDT ongoing/not ongoing labels and T319a in RRC/MAC specs per the following:

[POST125][026][MT-SDT] Fix “ongoing” procedure (ZTE)

Intended outcome: Review updated changes to “ongoing” procedure and identify any additional issues/clarifications needed. Provide agreable CR as input to next Plenary.

Deadline: Long

# Discussion

# Analysis of RRC spec

Currently, in various checks are done to ascertain whether SDT is ongoing or not and based on this, different UE behaviour is defined for the UE. This is summarised in the Figure 1 below:

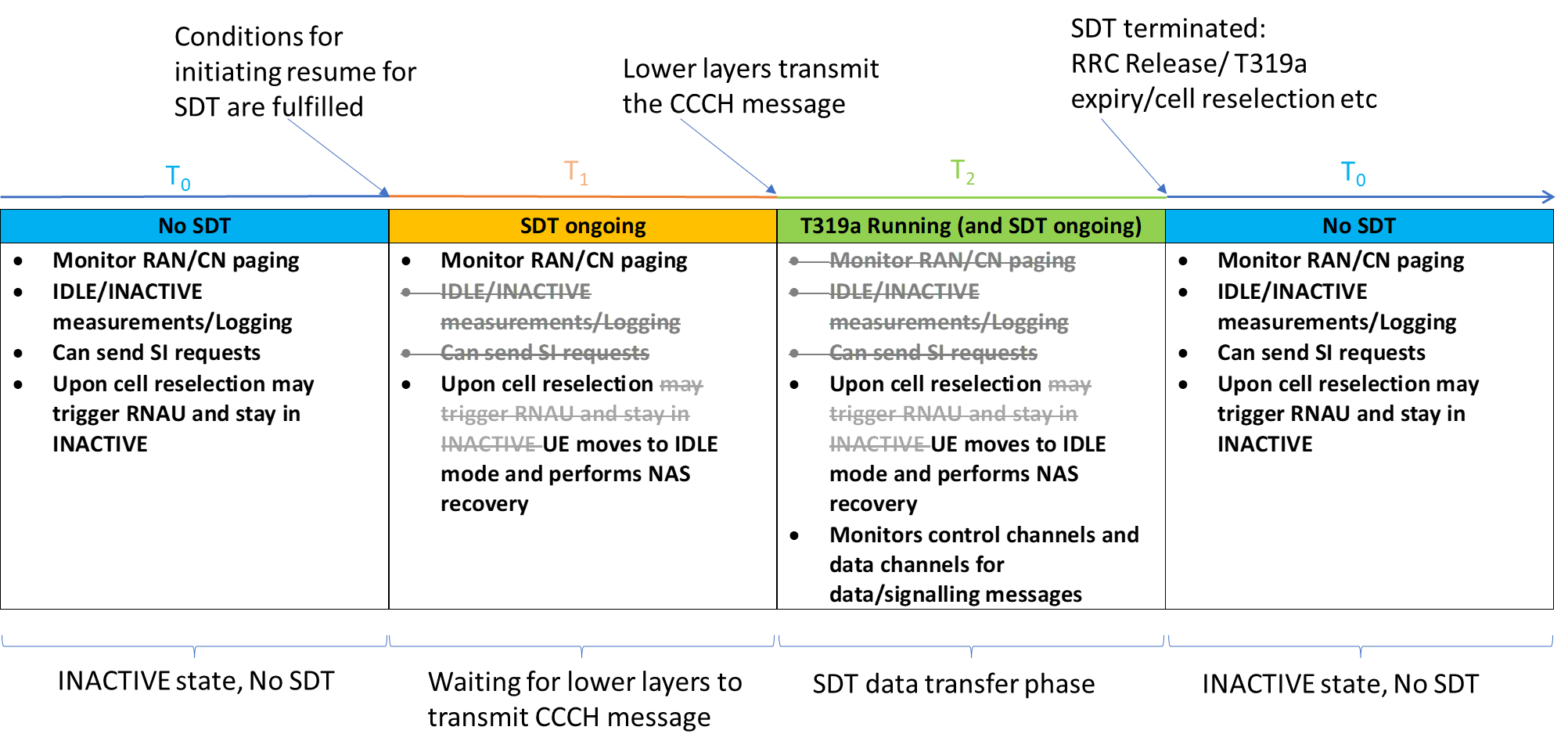


Figure : Overview of SDT handling in RRC

As noted above, SDT is considered to be ongoing immediately after conditions for SDT are fulfilled whilst T319a is started only upon the lower layers first transmitting the CCCH message. UE behaviour is different before and after T319a is started in this case as shown above. In Rel-18 the time duration between the point when SDT is considered ongoing and T319a is eventually started (i.e. possible duration of T1) has been extended because of the extended CG periodicities. The main point to emphasise in Figure 1 is that upon considering that SDT conditions are fulfilled in RRC, UE behaviour changes (see the transition from T0 to T1 in the figure above). This is the reason why use the label “SDT ongoing” in the current RRC spec.

**Observation 1: Per the current RRC specification:**

1. **SDT is ongoing**: From the point when conditions for SDT are fulfilled until SDT is terminated
2. **T319a runs**: From the point when MAC first transmits the CCCH message until the SDT is terminated. It should be noted that SDT is considered ongoing during this period of time. i.e. while T319a is running SDT is ongoing too.
3. **When SDT is ongoing but T319a is not running:** UE is waiting for lower layers to transmit the CCCH message and the UE behaviour is different in this time period compared to the UE behaviour immediately before SDT conditions are satisfied (The difference is in IDLE/INACTIVE measurements, logging of available measurements (see sections 5.5a.3.2, 5.7.8) and cell reselection behaviour (see section 5.3.13.6)).

First companies are asked whether the they agree with the above observation with respect to the current RRC spec.

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| **Q1: With regards to the modelling of *SDT ongoing* label and *T319a* timer in RRC, do companies agree with observation 1 above** | | |
| Company | Yes/No | Comment |
| Ericsson | Yes |  |
| LGE | Yes |  |
| Huawei, HiSilicon | Yes | Additionally, the following is captured in the RRC specifications:  “NOTE 1: The UE in RRC\_CONNECTED is only required to acquire broadcasted *SIB1* and MBS broadcast if the UE can acquire it without disrupting unicast or MBS multicast data reception, i.e., the broadcast and unicast/MBS multicast beams are quasi co-located. The UE in RRC\_INACTIVE state while SDT procedure is ongoing, is only required to acquire broadcasted *SIB1* and *MIB* if the UE can acquire them without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.”  This requirements relaxation is due to the fact that the UE was supposed to be monitoring control channels and transmitting/receiving data while the SDT procedure is ongoing, but the UE only does that when T319a is running, so this note is currently incorrect. |
| ZTE | Yes |  |
| Intel | Yes, with comments | When RAN2 agreed to change the start instance of T319a to be at the time that the 1st CCCH msg is transmitted (instead than when *RRCResumeRequest* for SDT was sent to the lower layers), this created an additional new/intermediate UE states/behaviours (which is shown in yellow in above diagram). As we commented at the time during the RAN2#123bis meeting discussion, we did not support this approach that seems to add unnecessary complexity to UE. |
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At RAN2#125, it was discussed to harmonise the labels for SDT ongoing/not ongoing and T319a start. For this the following options exist:

Option A: Consider SDT as ongoing at the same time as T319a start

Option B: Start T319a at the same time as SDT is considered ongoing

The issue with option B is that T319a may expire before the lower layers actually transmit the CCCH message. So, if we go with option B, some further discussion is needed, e.g. to not actually count down T319a until lower layers transmit the CCCH message etc. Such handling of timer doesn’t really exist in the specs today. In R2-2400585, option A was proposed. So, first we can check whether companies agree that we attempt to harmonise this using option A.

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| **Q2: Do companies agree that we should attempt to specify option A (but not option B)?** | | |
| Company | Yes/No | Comment |
| Ericsson | Yes | It seems also to be significantly less impact to the specifications with option A. |
| LGE | Yes |  |
| Huawei, HiSilicon | Yes | Going back to option B should not be considered as it will cause the issues that we wanted to avoid in the first place (by decoupling T319a from SDT ongoing), as described by the rapporteur. |
| ZTE | Yes | Option B will anyway need some handling for paging monitoring. So, there seems to be no benefit of attempting option B. |
| Intel | Yes | The intention not to start T319a before actual sending CCCH msg was because the timeout of T319a triggers an abrupt termination (failure) of the SDT procedure and this should not happen if UE has to wait for long time before having UL resources available to send the 1st CCCH msg (e.g., when using a long value for the CG-SDT periodicity).  This option A) could easily be enabled as follows:  1> if conditions for initiating SDT in accordance with 5.3.13.1b are fulfilled:  2> consider the resume procedure is initiated for SDT;  2> start timer T319a when the lower layers first transmit the CCCH message;  2> consider SDT procedure is ongoing when the lower layers first transmit the CCCH message;  1> else:  2> start timer T319;  2> instruct the MAC entity to stop the *cg*-*SDT*-*TimeAlignmentTimer*, if it is running; |
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However, if we go with option A, then, the question is whether we still allow the UE behaviour to be different before and after T319a starts. Specifically, the UE behaviour for the following aspects needs to be kept in mind:

1. Paging monitoring:

For paging monitoring, we explicitly agreed that before T319a start UE shall monitor paging and may initiate a new resume procedure if conditions are fulfilled. But after T319a starts, UE doesn’t monitor paging for MT data (i.e. follows same approach as in connected state). Rapporteur thinks that this behaviour shall be retained as agreed (as otherwise there will be a long duration when the UE may be waiting for the lower layers to transmit the CCCH message but won’t monitor paging especially with longer CG periodicities in Rel-18). It should be noted that option A above would not impact this because currently we check whether T319a is running or not for the paging monitoring (so, even if we move SDT ongoing label to T319a start, there is no impact). However, if we went with option B, then this procedure will be impacted and we will then need to discuss how to specify that UE still monitors paging until CCCH message is transmitted.

1. IDLE/INACTIVE measurements (see sections 5.5a.3.2, 5.7.8)

IDLE/INACTIVE measurements were excluded during SDT in Rel-17 and specified like this since Rel-17. So, for this behaviour, there is no difference before and after T319a start. However, the behaviour is different to the UE behaviour before SDT is initiated. Option A will impact this procedure because currently we check whether SDT is ongoing or not for this and if we go with option A, then UE behaviour will need to be discussed during the period until T319a starts.

1. SI requests

SI request may involve a new RACH procedure and to avoid the complexity of interactions with an ongoing SDT procedure it was agreed in Rel-17 that UE is not allowed to initiate SI request procedure once SDT conditions are fulfilled. Also, for this, there is no difference in UE behaviour before and after T319a start, but the UE behaviour is different to the behaviour before SDT is initiated. Again, Option A will impact this procedure because currently we check whether SDT is ongoing or not for this and if we go with option A, then UE behaviour will need to be discussed during the period until T319a starts.

1. Cell reselection

Cell reselection would render the CCCH message submitted to lower layers invalid. So, the lower layers shall not transmit the submitted CCCH message in the new cell. Optimisations are possible here to stop the lower layers from transmitting the old CCCH message and initiate a new resume procedure (this would then be similar as receiving a paging message whilst waiting for lower layers to transmit CCCH message, so this is feasible in theory). But we did not discuss such optimisation so far and hence currently, the UE moves to IDLE mode in this case (i.e. no optimisation) and performs NAS recovery. Again, option A will impact this procedure.

Given the above background, in case we go with option A, the first question is if we still maintain the current UE behaviour unchanged (at least for some cases) before T319a is eventually started (especially see items 2), 3) and 4) above).

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| **Q3: For option A, do companies agree that the UE behaviour for paging monitoring, IDLE/INACTIVE measurements, SI requests and cell reselection still needs to be kept unchanged during T1 (i.e. whilst lower layers are waiting for CCCH transmission) in Figure 1?** | | |
| Company | Yes/No | Comment (please explain in the comments if some aspects need to be changed and explain why) |
| Ericsson | No | Seems like the behaviour of T0 could be extended up until the start of T2 (T319A started) for 2), 3) and 4) above. Essentially, the SDT decision does not impact anything in our mind and the CCCH message is the only visible sign outside the UE. |
| LGE | No | Agree with Ericsson. UE can perform the addressed UE behaviour until T319a starts same as T0. |
| Huawei, HiSilicon |  | For 1), we agree there is no impact.  For 2) and 3), the UE can simply behave as in time T0 in the figure as the SDT procedure would not be ongoing during this time. There seems nothing to be discussed in this case.  For 4), Similarly as above, the UE will behave as if the SDT procedure was not ongoing, so UE would perform normal cell reselection. What might need to be specified is for the UE to cancel sending of the CCCH message and initiate a new resume procedure (i.e. check the SDT conditions again etc.). |
| ZTE | No | If we attempt option A, we think we should make the UE behaviour to be same in T1 as it is in T0. Otherwise, there will still be some need for different specification and checks. |
| Intel | No | Agree with Ericsson. |
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If there is still some difference in UE behaviour before T319a starts (as is the case currently), then specifying this different behaviour would need some check in RRC (currently we check whether SDT is ongoing), if this is the case, then moving the current label of “SDT ongoing” to the same time as T319a start point seems an artificial change (may be, we have to check a different label like lower layers are waiting for CCCH transmission etc, but the benefit of this is unclear). This will need some case-by-case analysis in RRC to specify the different UE behaviour and can be done based on the actual CR if companies still prefer this (depends on answers to Q3 above).

On the other hand, if we change the UE behaviour during this period (e.g. to match the UE behaviour whilst T319a is running), then this is not an editorial exercise anymore. Especially if we were to change the behaviour for IDLE INACTIVE measurements, logging and cell reselection behaviour.

So, we can check first if companies are still willing to unify the T319a start and SDT being considered ongoing at the same point in time even if there are differences in UE behaviour before and after T319a starts.

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| **Q4: If at least some of the UE behaviour during T1 is different to the UE behaviour during T0, do companies still prefer option A to harmonise the SDT ongoing label with T319a start point?** | | |
| Company | Yes/No | Comment |
| Ericsson | Yes |  |
| LGE | Yes | But, if there is difference between T0 and T1, it would be better to name the T1 explicitly, e.g. “SDT preparation”. |
| Huawei, HiSilicon | Yes | As we clarified above, by moving the point of when “SDT procedure is ongoing” to the point where currently T319a is started (i.e. when CCCH message is sent), we do not have to modify UE behaviour too much. Before “SDT procedure is ongoing” the UE would behave in the same way as it is currently behaving when ”SDT procedure is not ongoing”, i.e. as shown in T0 in then figure above. The only additional point we need to handle is to clarify that after the cell reselection the resume triggered in the previous cell is cancelled. |
| ZTE | No | We think ideally, we should make the UE beharviour in T1 same as T0 so that we can then make the SDT ongoing at the same point as T319a start. Without this, we are not exactly sure about the benefits of this. |
| Intel | Yes | As explained in Q3, the UE behaviour in T0 and T1 should be the same. |
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If SDT is considered ongoing at the same time as T319a start, then in RRC, it would seem to be unnecessary to have two separate labels for the same event (we can simply rely on T319a start in this case). The reason why we have two labels now is because we have different UE behaviour and the two labels come into effect at different points in time. If they refer to the same event, then it seems maintaining both is not useful in RRC. Companies are asked whether we should then simply get-rid of the SDT ongoing/not ongoing labels if we go with this approach.

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| **Q5: If we go with option A, then should we clean-up RRC and get rid of the SDT ongoing/not ongoing labels in RRC and simply rely on T319a running/not running?** | | |
| Company | Yes/No | Comment |
| Ericsson | Yes | Should be unified. Up until CG-SDT extended periodicities there was only one label. Preferably we could rely on the T319a instead of SDT procedure ongoing. |
| LGE | No | We want to align the terminology between RRC and MAC. If we use “T319a running”, it is not proper to specify T319a in MAC. Thus, we prefer to keep “SDT ongoing”, and clean-up both RRC and MAC with this terminology. |
| Huawei, HiSilicon | Rather not | We would prefer to keep the current “SDT procedure is ongoing” label as it is clearer. However, we do not have a strong view on this. |
| ZTE | Yes | If T319a and STD ongoing happens at the same point, it would be better to refer to the same label in RRC. So, we support this simplification. |
| Intel | Neutral | We are ok to keep T319a running only as well as both as soon as it is clear that there is no intermediate UE behaviour and it is the same when saying “T319a is running” and “SDT is ongoing”. |
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Finally, even if we don’t go with option A, rapporteur wonders if there is some further clarification needed in RRC to clarify the SDT ongoing/not ongoing labels to improve the spec readability/understanding.

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| **Q6: Regardless of option A, do companies think there is some other clarification needed in RRC to clarify the SDT ongoing/not ongoing checks?** | | |
| Company | Yes/No | Comment |
| Ericsson | Yes | Prefer to have it clarified in the definitions chapter so it will be visible that an SDT procedure can be either ongoing or not ongoing. |
| LGE | Yes | We prefer to clarify the definition of “SDT ongoing” clearly, and use this terminology for both RRC and MAC. |
| Huawei, HiSilicon | Yes | We think we should harmonise, but if we decide not to, it would be worth clarifying this somewhere, either in 38.331 or at least in 38.300. |
| ZTE | May be no | If we don’t go with a full clean-up, then we would prefer to keep everything as it is. |
| Intel | Maybe | This could be revisit after/when the CR is drafted. |
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# Analysis of MAC spec

MAC has the following labels:

* CG-SDT procedure ongoing / not ongoing
* SDT procedure ongoing / not ongoing

However, there seems to be no formal definition within the MAC spec for when to consider the CG-SDT and SDT procedure to be ongoing or not. It is also the case that the SDT ongoing/not ongoing within MAC is not associated with the same conditions in RRC discussed above in section 2.1 (e.g. conditions for SDT being fulfilled in RRC may not necessarily trigger the SDT to be considered ongoing in MAC etc).

In order to keep the MAC spec self-contained and avoid cross dependencies between the spec, one option could be to define the SDT ongoing and CG-SDT ongoing labels within MAC explicitly. To do this, we should first understand when SDT/CG-SDT should be considered ongoing in MAC.

Rapporteur’s understanding is that from MAC perspective, for RA-SDT, SDT procedure is ongoing from the point when the RA procedure is initiated for SDT until SDT is terminated.

Similarly, CG-SDT is ongoing from the point when initial transmission for CG-SDT is performed until the SDT procedure is terminated.

Companies are invited to comment on the above understanding:

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| **Q7: Do companies agree that in MAC, for RA-SDT, the SDT procedure is ongoing from the point when the RA procedure is initiated for SDT until SDT is terminated?** | | |
| Company | Yes/No | Comment |
| Ericsson | Yes |  |
| LGE | No | We think both CG-SDT and RA-SDT should be considered as ongoing when CCCH message is transmitted, same as RRC.  The rapporteur’s suggestion has a problem in that the start time of SDT procedure is different between CG-SDT and RA-SDT. For RA-SDT, the time point of CCCH transmission is different from the RA procedure initiation. |
| Huawei, HiSilicon | Yes | We think what the rapporteur proposes is OK. As pointed out by LGE, there will be some difference between RA-SDT and CG-SDT, but this does not seem to create any issues while the current MAC design seems to assume the procedure is ongoing already when RACH was triggered. Hence, the rapporteur’s proposal allows to avoid unnecessary changes. |
| ZTE | Yes | We don’t think that we need to align this across RRC and MAC. RRC has different conditions for when SDT is to be considered ongoing from RRC perspective. MAC can have MAC specific considerations. If we get rid of SDT ongoing labels from RRC anyway, we think we can try to clarify MAC on its own. |
| Intel | Maybe no but, see comment | SDT General section §5.27.1 uses the reference **“SDT procedure is initiated for MO-SDT” (or MT-SDT)** and there is currently no reference in MAC to ongoing RA-SDT procedure (apart than a reference in §5.4.6 (“All triggered PHRs shall be cancelled when there is an ongoing SDT procedure”)). Therefore, it is unclear if any clarification or change is needed in MAC for RA-SDT. Moreover, MAC already captures when MAC entity is configured with SDT and when SDT proc is initiated:  “**The MAC entity may be configured by RRC with SDT and the SDT procedure may be initiated by RRC layer for MO-SDT or MT-SDT**. The SDT procedure initiated for MO-SDT can be performed either by Random Access procedure with 2-step RA type or 4-step RA type (i.e., RA-SDT) or by configured grant Type 1 (i.e., CG-SDT). The SDT procedure initiated for MT-SDT can be performed either by Random Access procedure with 2-step RA type or 4-step RA type (i.e., RA-SDT is not applicable as specified in clause 5.1.1b) or by configured grant Type 1 (i.e., CG-SDT).” |
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| **Q8: Do companies agree that in MAC, for CG-SDT, CG-SDT procedure is ongoing from the point when initial transmission for CG-SDT is performed until the SDT procedure is terminated?** | | |
| Company | Yes/No | Comment |
| Ericsson | Yes |  |
| LGE | Yes |  |
| Huawei, HiSilicon | Yes | See above |
| ZTE | Yes |  |
| Intel | Yes but, see comment | As explained in Q7, SDT General section §5.27.1 uses the reference “SDT procedure is initiated for MO-SDT” (or MT-SDT) and in general no changes seem needed due to the change currently discussed to RRC.  On other hand, MAC also captures the terminology “CG-SDT procedure is ongoing” in sections §5.1.4a (MSGB reception and contention resolution for 2-step RA type), §5.2 (Maintenance of Uplink Time Alignment) and §5.4.6 (All triggered PHRs shall be cancelled when there is an ongoing SDT procedure). In some of those related reference, it also refers to the CG-SDT triggered MAC §5.27.1. Maybe some clarification is needed in MAC on this, but we understand that this is independent to the change of the ongoing discussion for RRC. |
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If companies agree with the above understanding, it can be clarified in the following way:

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| 5.27 Small Data Transmission  5.27.1 General  …  If Random Access procedure is selected above for SDT procedure initiated for MO-SDT or MT-SDT, the MAC entity considers that SDT procedure is ongoing and after the Random Access procedure is successfully completed (see clause 5.1.6), the UE monitors PDCCH addressed to C-RNTI received in random access response until the SDT procedure is terminated. If CG-SDT is selected above after the initial transmission for CG-SDT is performed, the MAC entity considers that CG-SDT procedure is ongoing and the UE monitors PDCCH addressed to C-RNTI as stored in UE Inactive AS context as specified in TS 38.331 [5] and CS-RNTI until the SDT procedure is terminated. |

Companies can comment on the above change and provide any other alternatives.

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| **Q9: Do companies agree with the above clarification in MAC?** | | |
| Company | Yes/No | Comment (please provide any alternative ways of clarifying this in MAC) |
| Ericsson | Yes | It will also be easier to read MAC/RRC spec if the label “SDT procedure is ongoing” is not used in both specifications with slightly different meaning. Thus this further strengthens the argument to use “while T319a is running” in RRC spec. |
| LGE | No | As mentioned in Q7, we think both CG-SDT and RA-SDT should be considered as ongoing when CCCH message is transmitted. This can be specified with general text. |
| Huawei, HiSilicon | Yes | We support having this clarification. |
| ZTE | Yes |  |
| Intel | No | These changes are not needed for current discussion as explained in the responses to Q7/Q8. On other hand, some change may be helpful for the CG-SDT part this or a different one. |
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Finally, we can check if there are any other clarifications needed in MAC.

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| **Q10: For the purpose of SDT / CG-SDT ongoing/not ongoing checks in MAC, are there any other clarifications/improvements needed in MAC?** | | |
| Company | Yes/No | Comment |
| Ericsson | No | Not if RRC mentions T319a only. |
| LGE | Yes | We think same clarification may be specified for both RRC and MAC for better understanding. |
| Huawei, HiSilicon | Seems not |  |
| ZTE | May be nothing else |  |
| Intel | Maybe | As explained in above comment, if any updated is needed for CG-SDT, this seems independent to current discussion; Rapp’s suggestion might be sufficient. |
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# Conclusion

**TBD**

# References

1. [R2-2400585](file:///C:/evutukuri/work/5G/RAN2/docs/R2-2400585.zip) Small Data Transmissions Control Plane Ericsson RAN2#125