

RAN

3GPP TSG RAN#97e draft [RP-222586]

Electronic Meeting, Sept. 12 - 16, 2022

Agenda Item 9.5.2.6

Source: RAN Vice-Chair (Deutsche Telekom)

Title: Moderator's summary of discussion for [97e-26-R17-SDT-NR-U]

Document for: Discussion & Decision

Objective:

This NWM thread discusses the content and proposal of **RP-222445** (ZTE Corporation, Sanechips).

Based on the discussion in RAN4#104-e RAN#97e need to decide a way forward, based on what has previously been agreed in the Rel-17 WI and the current discussion and load situation of RAN4.

The aim is to decide, if any NR-U specific enhancements either in the core specs or in performance specs for the combination of SDT with NR-U are within the scope of the Rel-17 WI or not.

Timeline:

According to the RAN chair's guidance in max. 3 rounds

1 Initial Round

1.1 Comments on RP-222445

This document addresses the question if any NR-U specific enhancements either in the core specs or in performance specs for the combination of SDT should be progressed in RAN4 as part of Rel-17 or not.

The author's proposal is the following:

Proposal: Rel-17 specs do not preclude combination of NR-U with SDT, but there is no need to specify any specific enhancements either in the core specs or in performance specs for the combination of SDT with NR-U as such enhancements are not within the scope of the Rel-17 WI.

Question 1 (*also please see/consider the observations provided in RP-222445*) :

Feedback Form 1: Do you agree that SDT as defined in Rel-17 can also work with NR-U ?

1 – MediaTek Inc.

Not really. It was stated in the WID that “Focus of the WID should be on licensed carriers and the solutions can be reused for NR-U **if applicable**.” We are actually not sure whether SDT can apply to NR-U based on current SPEC. In any case, it should be noted that the WID (core part) is already closed. Further optimization/enhancement on core SPEC is NOT justified.

2 – ZTE Corporation

Yes.

There are no known show stoppers as noted in our contribution.

We think both RA-SDT (for which the conclusion is fairly obvious) and for CG-SDT (where the framework defined for SDT can be reused in unlicensed spectrum), the above conclusion applies.

The WI clearly allows reusing the solution in unlicensed spectrum and unless the WGs explicitly identify any show stopper, we think there is no need to preclude the combination of SDT over unlicensed spectrum artificially.

3 – vivo Mobile Communication Co.

Agree. We think there is no need to specify any specific enhancements. SDT CG procedure could be used for both licensed spectrum and shared spectrum.

4 – LG Electronics Inc.

No. The NR-U relies on cg-RetransmissionTimer, but if it is configured for SDT, there will be an error in NDI and UL grant handling, according to current MAC specification. This is because RAN2 made MAC specification based on the assumption that the cg-RetransmissionTimer is not configured for SDT. Therefore, the SDT is not workable for NR-U.

5 – Ericsson LM

We do NOT agree with that statement, ”that SDT as defined in Rel-17 can also work with NR-U”.

For SDT to work on NR-U carrier RAN4 needs to define some NR-U specific requirements e.g. at least both maximum number of CCA failures and UE behaviour when the CCA failures exceed when the UE validates TA, transmit using SDT etc. These aspects are missing in RAN4 specs. Therefore, the consequence will be that the SDT will not work if used on NR-U carrier.

6 – Apple Poland Sp. z.o.o.

We are open to discuss the SDT with NR-U. Regarding the proposal, we are wondering what enhancement means here in this issue. To us, applying NR-U related mechanism to SDT, e.g., UE behavior when reach max LBT failure, may not be treated as an enhancement but just reuse same mechanism of NR-U to SDT procedure, even though the new RAN4 requirement will be introduced.

7 – Samsung Electronics Co.

Yes.

8 – CATT

Regarding the combination of SDT and NR-U we also think that there might be some issues to further discuss regarding MAC procedure and R4 performance requirements, as has been mentioned by some companies. Then we agree with Mediatek's point that Rel-17 has frozen so it does not see valid to do any further enhancements at all.

9 – Xiaomi Communications

Yes

10 – Deutsche Telekom AG

We have no clear view if SDT works with NR-U or not.

But if there are issues to be solved it shall NOT be done in Rel-17 as Rel-17 is frozen since some time already and no time is available addressing this either. So it should be deferred to Rel-18 the earliest ...

11 – Qualcomm Incorporated

Yes and No.

As far as RAN1/2 spec is concerned, SDT can work with NR-U. On the other hand, if the question is whether SDT can be enabled in real NR-U deployments, we do not yet think the answer is 'yes' because the corresponding requirement in RAN4 hasn't been yet defined.

Regarding TA validation for CG-SDT, although the mechanism is defined in RAN2 spec, the definition of reference RSRP for TA validation in CG-SDT and when/where to measure RSRP for the validation are left to RAN4 spec. Therefore, the details and the requirements for both licensed and unlicensed bands should be defined in RAN4 spec to make the feature applicable to each.

12 – ZTE Corporation

We just wanted to clarify a few points highlighted by companies above.

With regards to the comments about cg-RetransmissionTimer, we would like to point out that SDT uses a different timer instead of the cg-RetransmissionTimer (cg-SDT-RetransmissionTimer). The procedure during SDT is self-contained and hence is independent of the cg-RetransmissionTimer. We don't see any issue with NR-U for this. As highlighted also above by other companies, this is the reason why we think there is no show stopper for NR-U with CG-SDT.

With regards to the RAN4 requirements highlighted above: Of course CCA check can happen at lower layers, however there is no requirements during INACTIVE state for what happens when CCA failure exceed the maximum number. Even in NR-U (i.e. without SDT), when T319/T300 are running we rely on a timer based mechanism to detect the failure rather than counter based mechanism (which counts CCA failures). So, it is not clear to us why we should change this behaviour of relying on a timer-based mechanism (which, in case of SDT would rely on T319a and hence would be independent of the number of CCA failures whilst T319a is running). No such discussion happened in RAN2 by the way and there are no corresponding UE behaviour specified for this in RAN2 specs for max CCA failures whilst T319a is running... the only failure detection mechanism is based on timer (T319a). It is not clear to us how/why we should change this framework now!

13 – Beijing OPPO Com. corp.

We are not sure whether R17 SDT works with NR-U. For CG-SDT, some NR-U specific mechanisms are not followed in current MAC spec, e.g., autonomous retransmissions based on *cg-RetransmissionTimer* (although we have *cg-SDT-RetransmissionTimer*, it is only applied to initial UL transmission), HARQ process ID selection, etc.

14 – LG Electronics Inc.

The issue with *cg-RetransmissionTimer* is explained below.

5.4.1 UL Grant reception

1> if the MAC entity is not configured with *lch-basedPrioritization*, and the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received on the PDCCH or in a Random Access Response or the PUSCH duration of a MSGA payload for this Serving Cell:

2> set the HARQ Process ID to the HARQ Process ID associated with this PUSCH duration;

2> if, for the corresponding HARQ process, the *configuredGrantTimer* is not running and *cg-RetransmissionTimer* is not configured and *cg-SDT-RetransmissionTimer* is not configured (i.e. new transmission):

3> consider the NDI bit for the corresponding HARQ process to have been toggled;

3> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

2> else if the *cg-RetransmissionTimer* for the corresponding HARQ process is configured and not running, then for the corresponding HARQ process:

3> if the *configuredGrantTimer* is not running, and the HARQ process is not pending (i.e. new transmission):

4> consider the NDI bit to have been toggled;

4> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

3> else if the previous uplink grant delivered to the HARQ entity for the same HARQ process was a configured uplink grant (i.e. retransmission on configured grant):

4> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

2> else if the *cg-SDT-RetransmissionTimer* is configured and not running for the corresponding HARQ process;

3> if the configured uplink grant is for the initial transmission for the CG-SDT with CCCH message (i.e., initial new transmission); or

3> if the *configuredGrantTimer* is not running or not configured, and PDCCH addressed to the MAC entity's C-RNTI has been received after the initial transmission of the CG-SDT with CCCH message (i.e., subsequent new transmission):

4> consider the NDI bit to have been toggled;

4> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

As can be seen above, if *cg-RetransmissionTimer* is configured and not running, the UE uses next CG resource to perform NEW UL transmission even if the initial transmission is not acknowledged. This will lead to unexpected SDT failure (when CGT expires for any of HARQ process) and wrong SSB selection.

15 – Nokia Corporation

Possibly. There has not been a complete analysis, however, RAN4 has identified some potential gaps for CG-SDT in NR-U in the case of LBT failures.

16 – ZTE Corporation

Thanks for explaining the concern regarding the cg-RetransmissionTimer (@LG).

However, just to clarify, since the UCI based HARQ indication is not supported for SDT anyway, the cg-Retransmission timer will not be configured for SDT. So, then it seems there is no issue. Of course companies can provide further analysis for this, but, we are not aware of anything that breaks with this combination.

17 – Ericsson LM

Ericsson2 comments: We do not agree with ZTE explanation that T319/T300 are running and can address the UE behaviour under CCA failures.

RAN4 SDT requirements involve several aspects. The basic aspects it that the UE uses valid RSRP1 and RSRP2 for determining whether the TA is valid or not. For SDT to work with NR-U, it is important that samples within RSRP1 and RSRP2 are not too far part due to CCA failures. This cannot be addressed any timer. Otherwise the UE might use invalid RSRP1 and/or RSRP2 to validate the TA even though the timer is still running.

So in summary without some NR-U specific RAN4 requirements for SDT, the SDT in NR-U will not be supported and will not work.

18 – ZTE Corporation

Thank you for the further explanation (@Ericsson).

We agree that RSRP based TA validation should be tested and RSRP1 and RSRP2 should not be too far (which is also a time based limit that works for licensed and unlicensed spectrum and is independent of CCA failures).

However, what is not clear to us is how this is dependent on the number of CCA failures. Specifically, why the UE should count the number of CCA failures within the SDT duration as an additional trigger to initiate SDT failure instead of maintaining a timer as defined currently.

The intention is that SDT failure is detected based on T319a expiry. Understanding here is that CG-SDT transmission can fail within the T319a (and this failure can happen either due to CCA failure or due to channel errors). What is unclear to us is why we should have the enhancement to count the number of CCA failures (in addition to relying on the T319a expiry) to detect the SDT failure (especially when relying on a timer rather than counting CCA errors whilst the T319 is running is also the legacy NR-U mechanism in any case). Also, it is unclear to us how the max number of CCA errors during SDT will be configured to the UE in this case (i.e. does this need new signalling?).

19 – VODAFONE Group Plc

In our view, no fundamental show stopper for SDT with NR-U has been clearly identified. However, if there is any issues to be investigated, we think that should be differed to Rel-18.

20 – HUAWEI TECHNOLOGIES Co. Ltd.

[Huawei] in our view more investigation is needed both in RAN2 and in RAN4 to understand this better, given also the different opinions expressed above. In particular it seems that at least some work is needed in RAN4 to make it working, e.g. in RRM. We are not asking for this work to be done, we are just answering the question from the moderator.

Question 2:

Feedback Form 2: Do you agree that no NR-U specific SDT enhancements shall be part of Rel-17 ?

1 – MediaTek Inc.

Yes - we should avoid further enhancement at current stage (considering both core and performance parts of the WI)

2 – ZTE Corporation

Yes.
The WI clearly requires that we should not have any enhancements in core or performance requirements specs for the combination of SDT with NR-U. So, such discussion should not happen now (especially after the core part has been completed).

3 – Nokia Corporation

Yes, we agree.

4 – LG Electronics Inc.

Agree.

5 – vivo Mobile Communication Co.

Yes.

6 – Ericsson LM

If there is big concern not to define SDT on NR-U in Rel-17, then we also fine not to define them. However we would like to clarify that NR-U specific SDT requirements (e.g. related to CCA failures) are NOT any kind of enhancements. Rather they are basic NR-U specific requirements which are absolutely necessary to make SDT work on NR-U carrier. As mentioned in answer to Q1, without such NR-U specific requirements SDT will NOT be supported for NR-U in Rel-17.

7 – Samsung Electronics Co.

Yes.

8 – CATT

Yes, as already stated in our response to the Q1

<p>9 – Xiaomi Communications</p> <p>Yes</p>
<p>10 – Deutsche Telekom AG</p> <p>Yes</p>
<p>11 – Qualcomm Incorporated</p> <p>We do not think defining requirements for NR-U is an enhancement. This is rather defining relevant requirements for different deployment scenarios, in this case for NR-U. As long as the requirements do not require any additional RAN1/2 design/signaling update, it shouldn't be called as *enhancement*.</p> <p>In summary, we support that RAN4 should define SDT requirements for both licensed and unlicensed bands as instructed by the WID, and the work should not require any specific RAN1/2 update for NR-U support.</p>
<p>12 – ZTE Corporation</p> <p>We agree with the comments above that there should be no changes to the core specs. It should also be kept in mind that whilst T319 is running, the basic NR-U procedure relies on a timer based mechanism and is independent of the number of CCA errors indicated by lower layers. So, it is not clear to us why we should define a counter based mechanism for CCA errors for SDT rather than relying on the existing behaviour!</p>
<p>13 – Beijing OPPO Com. corp.</p> <p>Yes. Agree with MediaTek.</p>
<p>14 – Apple Benelux B.V.</p> <p>We are OK, under the condition that no new functional enhancements will be introduced.</p>
<p>15 – VODAFONE Group Plc</p> <p>yes, we agree.</p>
<p>16 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>[Huawei] yes, that is clear.</p>

1.2 Summary of the Initial Round

Moderator's summary of the initial round of discussion

In the initial round 2 main questions were asked by the moderator:

1.1 Do you agree that SDT as defined in Rel-17 can also work with NR-U ?

YES:

ZTE, vivo, Samsung, Xiaomi

Further discussion

Apple, Qualcomm, VF ?

NO/Not sure

MediaTek, LGE, Ericsson, CATT, DT, OPPO, Nokia, Huawei

In the discussion 4 companies expressed their view that they believe SDT in Rel-17 can also work with NR-U. 8 Companies expressed their view that they are not sure or do not expect that the work is progressed that SDT can work with NR-U, 3 companies expressed that further discussion would be needed.

Conclusion: Majority of companies believe that SDT as defined in Rel-17 might / does not work with NR-U. As the latest WID in RP-212594 states that “Focus of the WID should be on licensed carriers and the solutions can be reused for NR-U if applicable.” The moderator proposes that the work on any NR-U enhancement / fixing shall be left for later releases and should not be progressed as part of the frozen Rel-17.

1.2 Do you agree that no NR-U specific SDT enhancements shall be part of Rel-17 ?

YES:

MediaTek, ZTE, Nokia, LGE, vivo, Samsung, CATT, Xiaomi, DT, OPPO, Apple ?, Vodafone, Huawei

NO:

Ericsson, Qualcomm (only RAN4 work is needed)

In the discussion 12 [13 ?] companies expressed their view no specific NR-U enhancements shall be part of Rel-17 for SDT. Only 2 [3] companies believed that further work on enhancements for operation of SDT in NR-U should be progressed as part of Rel-17.

Conclusion: Also inline with the above question, the moderator proposes that the work on any NR-U enhancement/ fixing shall be left for later releases and should not be progressed as part of the frozen Rel-17.

2 Intermediate Round

The moderator proposes that **no further work to enable or enhance operation of SDT in NR-U should be progresses as part of Rel-17**. This is motivated by the replies in the initial round, the fact that the focus of the WI was on licensed spectrum, Rel-17 is finalised since some time and RAN4 could not conclude (ccording the SR) ”Whether or not RAN4 specifies SDT requirements for NR-U”.

Feedback Form 3: Agree with the moderator's proposal (YES / NO)

1 – Qualcomm Incorporated

We do not agree with the moderator's observation and proposal.

To us, what has been observed in the first round of the discussion is as follows:

- (1) No technical issue in RAN1/2 spec hasn't been identified. There was one technical concern which was debunked by another company. Thus, there is no technical issue identified. Other than that, we haven't seen any technical issue from RAN1/2 spec perspective.
- (2) From RAN4 spec point of view, however, there was a concern that SDT requirements defined by RAN4 have not yet taken into account NR-U specific issues mainly related to LBT failure, which effectively makes the feature inapplicable to NR-U. In other words, even without any NR-U specific enhancements in RAN1/2 spec, the feature can be enabled in NR-U deployment if RAN4 defines the corresponding requirements.

With the observation above, the question is now a matter of whether RAN4 defines the requirements or not. We propose:

- Rel-17 SDT is applicable to NR-U. How to define the requirements is left to the corresponding working group level discussion (RAN4) as part of Rel-17 under the condition of no-cross working group impact.

2 – Samsung Electronics Co.

Yes, we can accept the moderator's proposal as it is.

3 – Xiaomi Communications

Yes

4 – LG Electronics Inc.

We are ok with the moderator's proposal.

However, for RAN2 impact, we still think NR-U cannot work if cg-RetransmissionTimer is not configured.

In our understanding, the following functions shall be supported for NR-U.

- CG retransmission upon LBT failure
- UCI based HARQ indication
- HARQ process sharing
- LBT failure recovery

If the cg-RetransmissionTimer is not configured, the first three functions do not work, but only the last one works.

If only the LBT failure recovery function is supported, can we say NR-U is supported?

<p>5 – vivo Mobile Communication Co.</p> <p>Yes</p>
<p>6 – CATT</p> <p>Yes, we support moderator’s proposal.</p>
<p>7 – ZTE Corporation</p> <p>Yes, we are also okay with the moderator’s proposal.</p> <p>However, we disagree with the view that CG-SDT cannot be used on unlicensed spectrum. None of the features described above as missing by other companies (either in RAN1/2 or in RAN4) are essential for CG-SDT to be used in unlicensed spectrum. So, we think SDT framework as defined by RAN2 can be used as it is in unlicensed bands.</p> <p>However, it seems the actual discussion on whether CG-SDT can or cannot be supported over unlicensed bands seems to be rather academic now as the core WI has now been complete (i.e., the plenary intervention is mainly needed only to guide RAN4 on what to do in the next quarter in the performance part). So, from this perspective, moderator’s proposal seems sufficient.</p>
<p>8 – LG Electronics Inc.</p> <p>@ZTE</p> <p>”Use on unlicensed spectrum” is not equal to ”NR-U is supported”. We agree that CG-SDT can be used on unlicensed spectrum, but NR-U is not workable on CG-SDT because cg-RetransmissionTimer cannot be configured.</p>
<p>9 – Beijing OPPO Com. corp.</p> <p>We are ok with the moderator’s proposal.</p>
<p>10 – MediaTek Inc.</p> <p>Yes, we agree with the moderator’s proposal.</p> <p>Based on the phase 1 discussion, there is clear no consensus on whether SDT can work on NR-U. Given the fact that the WID focus on licenced band, it does not make sense to add additional work to RAN2/RAN4 on combination of two features. It is time to close Rel-17 item including performance part.</p> <p>BTW, one editorial comment on ”no further work to enable or enhance operation of SDT in NR-U should be progresses as part of Rel-17” -> Should be ”progressed”.</p>
<p>11 – ZTE Corporation</p> <p>@LG.</p> <p>Thanks for confirmation. Good to see we are on the same page about the fact that <i>CG-SDT can be used on unlicensed spectrum</i>. This is indeed what we meant with our comments during this discussion. This can be clarified if seemed appropriate in the proposal:</p>

<p>”no further work to enable or enhance operation of SDT in <u>unlicensed spectrum</u> should be <i>progressed</i> as part of Rel-17”</p>
<p>12 – Nokia Corporation</p> <p>We are ok with the moderator’s proposal.</p>
<p>13 – VODAFONE Group Plc</p> <p>We are ok with the moderator’s proposal.</p>
<p>14 – Ericsson LM</p> <p>We support Qualcomm’s proposal to allow discussion in RAN4 as part of Rel-17 under the condition there is no cross working group impact. In our view RAN4 impact is minimal and can done in one quarter. RAN4 can be tasked to complete requirements in 1 quarter (Q4).</p> <p>Otherwise (without some LBT specific requirements in RAN4) in our view the consequence is that SDT cannot work on NR-U band from RAN4 requirements perspective.</p>
<p>15 – CableLabs</p> <p>We are okay with the proposal</p>
<p>16 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>[Huawei] we are OK with the moderator’s proposal</p>

2.1 Summary of the Intermediate Round

The moderator proposed: **“no further work to enable or enhance operation of SDT in NR-U should be progressed as part of Rel-17”**

Agree: Samsung, Xiaomi, LGE, vivo, CATT, ZTE, OPPO, MediaTek, Nokia, Vodafone, CableLabs, Huawei

Disagree: Qualcomm, Ericsson

There is a clear majority of 12 (out of 14) companies who do not want to progress any further work on SDT for usage in NR-U. The 2 disagreeing companies claim that only minimal 1 quarter work is needed in RAN4 to define LBT specific requirements in RAN4 to enable SDT can work in NR-U

As moderator I suggest that we do not progress the work to enable SDT on NR-U further as part of Rel-17.

This discussion can be closed with this WF.