3GPP TSG-RAN WG2 Meeting #118-e R2- 220xxxx

Online, 9th May – 20th May, 2022

Source: CATT

Title: Report of [AT118-e][071][ePowSav] RRC (CATT) – Phase 2

Agenda Item: 6.9.1.3

Document for: Discussion and Decision

# Introduction

This contribution provides the report of the Phase 2 of the following email discussion:

* [AT118-e][071][ePowSav] RRC (CATT)

Scope: 1. For TRS/CSI-RS Address remaining issues, from tdocs under 6.9.3.3. not already addressed, Identify agreements, discussion points, etc. 2a. Allow further checking of the RRC Rapporteur resolutions in the RRC CR. 2b. Update the CR acc to meeting agreements

Intended outcome: 1. Report. 2 Agreed CR (in the end)

Deadline: CB W2 Tuesday, CR agreement expected by Post meeting discussion.

As background, the Chair’s notes for the related on-line discussion are copied below:

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| R2-2206493 Report of [AT118-e][071][ePowSav] RRC (CATT) CATT  DISCUSSION  P3   * CATT think this is for a stable configuration, for which there is no need to frequently re-activate. * Xiaomi prefer R1 decision, but no strong concerns. * QC want to add the comment that it doesn’t override the validity timer.   P1   * Xiaomi want to make further clarifications. * add the “infinity” value to the field *validityDuration (not intended to override the SIB validity timer).* * RAN2 understands there is no possible conflict or ambiguity between TRS/CSI-RS configuration broadcasted in SIB17 for idle/inactive UEs and TRS/CSI-RS configuration provided via dedicated signaling for connected UEs. No specification change is required.   Chair: P1 (or variant thereof) for email/offline agreement. |

And the related P1 was:

**Proposal 1 (17/17): UE considers the validity duration is ended at the boundary of the modification period during which UE receives the changed TRS/CSI-RS configuration or until the validity time duration expires, whichever is earlier.**

# Contact Information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email** |
| CATT | Pierre Bertrand | pierrebertrand@catt.cn |
| Ericsson | Martin van der Zee | martin.van.der.zee@ericsson.com |
| Xiaomi | Yanhua Li | Liyanhua1@xiaomi.com |
| Qualcomm | Linhai He | linhaihe@qti.qualcomm.com |
| Sequans | Noam Cayron | noam.cayron@sequans.com |
| Intel Corporation | Seau Sian Lim | seau.s.lim@intel.com |
| Samsung | Anil Agiwal | anilag@samsung.com |
| LGE | Soo Kim | soo.kim@lge.com |
| Sharp | LIU Lei | lei.liu@cn.sharp-world.com |
| Nokia | Jussi Koskinen | jussi-pekka.koskinen@nokia.com |
| Vivo | Chenli | Chenli5g@vivo.com |
| MediaTek | Li-Chuan TSENG | li-chuan.tseng@mediatek.com |
| Huawei, HiSilicon | Jagdeep Singh | [jagdeep.singh6@huawei.com](mailto:jagdeep.singh6@huawei.com) |
| Apple | Sethuraman Gurumoorthy | sethu@apple.com |
| CMCC | Xiaoxuan Tang | tangxiaoxuan@chinamobile.com |
| ZTE | Fei Dong | dongfei@zte.com.cn |
| OPPO | Haitao Li | [lihaitao@oppo.com](mailto:lihaitao@oppo.com) |

# TRS/CSR-RS remaining issues

## TRS availability when SI change

In [1], it is discussed a potential issue when the TRS/CSI-RS configuration is changed during the validity duration, as illustrated in Figures 1 and 2:



**Figure 1: TRS configuration is changed during the idle/inactive TRS validity duration configured by RRC**



**Figure 2: UE receives the validity indication duration and the TRS/CSI-RS change indication at the same**

[1] questions whether the UE still follows the legacy validity duration configured by RRC in these cases, or if another behavior should be expected. Specifically, [1] suggests two options:

* Option 1: UE still considers the updated TRS/CSI-RS as available until the validity duration time duration expires (no specification change).
* Option 2: UE considers the validity duration is ended at the boundary of the modification period during which UE receives the changed TRS/CSI-RS configuration or until the validity time duration expires, whichever is earlier.

[1] argues Option 2 could allow a clean separation of the L1 based availability indications for the old and new configurations.

**Q1. Which option do you support from Option 1 and Option 2?**

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| --- | --- | --- |
| **Company** | **Option1/2** | **Comment** |
| Ericsson | Option 2 | We think it needs to be clarified when L1 and L3 indicate something differently. In our understanding L3 should be leading here, e.g. the configuration might have changed or removed, in which case the L1 indication obviously is not valid anylonger. |
| Xiaomi | Option2 | I think we are meaning here is:  The TRS/CSI-RS availability is assumed to be ‘unavailable’ for all the TRS resource set group(s) upon getting the TRS/CSI-RS configuration modification.  Not only for the TRS resource set group whose configuration is changed, right? |
| Qualcomm | Option 2 | Agree with Ericsson |
| ZTE | Option 2 | From NW point of view, even though the scenario mentioned here we think it is not common since the intention of introduction of L1 indication is actually for not change the TRS Configuration during the validity period, we still think L3 signaling shall have a priority than L1 indication in case such an abnormal scenario really happen in the real deployment. |
| Sequans | Option 2 | Agree with Ericsson |
| Intel | Option 2 |  |
| Samsung | Option 2 | Once the configuration is changed, L1 indication for old configuration is not valid. New L1 indication is needed for availability indication of updated configuration. |
| LGE | Option 2 | Before UE starts SI update procedure, it may use TRS resources that was indicated before UE obtains the SIB for TRS configuration. Therefore, if an SI update procedure is performed(at the boundary of the modification period), the UE should consider the TRS as unavailable. |
| Sharp | Option 2 |  |
| Nokia | Option 2 | Agree with Ericsson |
| vivo | Option 2  (proponent) | As we have agreed, when UE acquires SIB-X with a TRS/CSI-RS configuration, it may receive the associated L1-based availability indication soon. Then if this SIB-X is changed within the previous valid duration time, UE may receive the changed TRS/CSI-RS configuration and new L1 based signaling within the valid duration time. And UE may be confused about how to deal with the new availability indication and the previous availability indication.  Besides, RAN1 has the following agreement in RAN1#107bis-e meeting:  *UE can receive L1 based signaling for TRS availability indication before the expiration/end of validity duration associated with previous L1 based signaling for TRS availability indication*   * *For each bit indicated as ‘1’ in the availability indication field of the current L1 based signaling ~~TRS availability indication~~, the UE assumes the corresponding TRS resource set(s) are available from the reference point until the end of the validity duration associated with the current L1 based signaling ~~indication~~.* * *For each bit indicated as ‘0’ in the availability indication field of the current L1 based signaling, the UE keeps the existing ~~current~~ assumption on the availability or unavailability of the corresponding TRS resource set(s).*   It can be observed that the indication of L1 based availability indication in and out of the validity duration is different. And in the above case, the new received L1 based signaling obviously should be considered as which is received out of the validity duration, which is not aligned with RAN1’s agreement.  Hence the case that TRS/CSI-RS configuration is changed within the validity time duration must be considered. And option2 is a straightforward method to resolve the issue. |
| CATT | Option 2 | Our understanding is that the L1 indication is associated with a TRS configuration (via the parameter *indBitID*), hence upon a new configuration it makes sense that the L1 indication associated with the old TRS configuration is no longer valid. |
| MediaTek | Option 2 | Agree with CATT |
| Huawei, HiSilicon | Option 2 | Agree with CATT |
| Apple | Option 2 | Agree with CATT |
| CMCC | Option 2 |  |
| OPPO | Option 2 |  |

Summary:

17 companies provided inputs to this question and all support Option 2.

**Proposal 1 (17/17): UE considers the validity duration is ended at the boundary of the modification period during which UE receives the changed TRS/CSI-RS configuration or until the validity time duration expires, whichever is earlier.**

## TRS availability when SI change – Phase 2

Although a majority of companies agreed the principle of Proposal 1 above, it seems some clarifications are needed on the exact related behavior. Specifically, during Phase 1 and online, Xiaomi had the following question:

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| Xiaomi | Option2 | I think we are meaning here is:  The TRS/CSI-RS availability is assumed to be ‘unavailable’ for all the TRS resource set group(s) upon getting the TRS/CSI-RS configuration modification.  Not only for the TRS resource set group whose configuration is changed, right? |

From rapporteur’s perspective, there could indeed be two understandings of Proposal 1.

Understanding 1: UE considers the validity duration is ended at the boundary of the modification period during which UE receives the ~~changed TRS/CSI-RS configuration~~  SI change notification or until the validity time duration expires, whichever is earlier.

In this case, Xiaomi is correct because, anyways, during this modification period, the UE does not know which TRS configuration *may* change, and actually it does not even know if SIB17 is impacted by the SI update. The drawback, of course, is that when the SI update is not for SIB17, then no TRS configuration is impacted although the network still needs to reactivate via L1 signaling all the TRS configurations.

Understanding 2: UE considers the validity duration is ended when ~~at the boundary of the modification period during which~~ UE receives the changed TRS/CSI-RS configuration in the modification period following a SI change notification or until the validity time duration expires, whichever is earlier.

Now, as commented by vivo below, understanding 2 can be further split into 2 sub-cases:

**Understanding 2-1: UE considers the validity duration for all TRS resource set groups is ended when UE receives the changed TRS/CSI-RS configuration in the modification period following a SI change notification or until the validity time duration expires, whichever is earlier.**

In this case, the UE stops the validity duration timer of all TRS configurations at the time it receives the updated SIB17. And the network needs to reactivate all TRS configurations via L1 signaling, but only upon SIB17 change, not for a SI update for other SIB(s).

**Understanding 2-2: UE considers the validity duration for the changed TRS resource set group(s) is ended when UE receives the changed TRS/CSI-RS configuration in the modification period following a SI change notification or until the validity time duration expires, whichever is earlier.**

In this case, the UE stops the validity duration timer of a TRS configuration at the time it receives the updated SIB17, if updated, and only for the TRS configuration that has changed. And the network only needs to reactivate the new TRS configuration via L1 signalling.

The difference between both sub-cases is that 2-2 is a further optimization of 2-1 at the cost of more UE complexity:

The list of TRS configurations in SIB17 is optional Need R. And so there is no delta configuration, meaning that even if the network only wants to update the validity duration without changing any of the TRS resources, it still needs to populate SIB17 again with the same list of TRS resources. So understanding 2-2 would require the UE to check if any of the fields of each TRS configuration in the new list of TRS configurations has changed compared to old values to assess if the TRS configuration has changed.

Rapporteur would like to check companies’ views on these two understandings.

**Q1a. Which understanding do you support?**

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| **Company** | **Understanding 1/2** | **Comment** |
| CATT | Understanding 2-1 | This approach saves significant L1 signalling from network side. It is anyways assumed that, from the modification period boundary up to the time UE acquires the changed SIB(s), UE implementation will not assume any TRS available and will use SSB instead.  And we do not think the additional complexity of 2-2 is worth the gain. |
| vivo | Understanding 2 with comments | My understanding is that the wording for original proposal is not accuracy enough with “*at the boundary of the modification period during which UE receives the changed TRS/CSI-RS configuration*”, as:  1. it is not reasonable for UE to determine the availability for a past time slot.  2. The UE cannot determine whether SIB17 will be changed when receiving SI change notification.  After checking companies’ response during email discussion, all companies agreed that the availability indication is no longer valid upon receiving new configuration.  Thus, we think understanding 2 is correct.  Regarding understanding 1, I donot think it is reasonable, as there will some false alarm cases if the SI change notification is not for the change of SIB17. This will restrict the use of TRS for idle/inactive UEs.  **Besides, even with understanding 2, we also could further discuss whether this is for all TRS resource set group(s) or only the changed TRS resource set group(s), i.e.**  **Understanding 2-1: UE considers the validity duration for all TRS resource set group(s) is ended when UE receives the changed TRS/CSI-RS configuration in the modification period following a SI change notification or until the validity time duration expires, whichever is earlier.**  **Understanding 2-2: UE considers the validity duration for the changed TRS resource set group(s) is ended when UE receives the changed TRS/CSI-RS configuration in the modification period following a SI change notification or until the validity time duration expires, whichever is earlier.**  We slightly prefer understanding 2-1, as NW should provide the configuration of all TRS resource set group(s) in SIB17. There is no delta configuration for SIB17. |
| Ericsson | Comments | This is perhaps a bit of an academic discussion, i.e. we suspect that a UE implementation will continue to use the configuration, until it **knows** it has changed, irrespective of what we specify.  This issue is the same at the MP boundary and SIB expiry, i.e. UE needs to check if the configuration is still valid. The UE **cannot assume** it is still valid, and the UE needs to check. From a specification perspective, we think that Understanding 1 is the correct understanding.  We do not see the need to explicitly state that the UE stops using the TRS configuration at the MP boundary with understanding 1, given that something else could (likely) have changed. So we wonder if we can find a simplified wording that captures this? For example in the *validityDuration* field description:  The duration is only valid while the UE has a valid *SIB17.*  We think that the UE can use the changed configuration for the remaining duration of the old configuration. But it is kind of strange that when a configuration is changed, that the UE assumes that it is not valid from the start.  When infinity is configured we do not want that every SI-change would cancel it. PS: for the "infinity" use case it would have been better and simpler to have a separate configuration flag whether L1 *validityDuration* or SIB scheduling is used. |
| LGE | Understanding 1 | If the SI update is for SIB17, before the UE starts the SI update procedure, the UE may use the previously configured outdated TRS resource.    We think Understanding 1 is simpler because SIB may not change frequently and we don't need to assume UE implementation. |
| Huawei, HiSilicon | Understanding 1 | We agree with Ericsson and also think that understanding 1 is simple and straight forward. |
| Xiaomi | Understanding 2-1 | TRS availability is not impacted by SI (Other than SIB17) change, otherwise we will constantly need the NW to send Lay1 indication.  So understanding 2 is correct.  As Rapp indicated that, no delta configuration so NW anyway needs to give the new configuration of TRS (even if some TRS resource set group is not changed), it is better UE to treat all the new configuration of TRS from unavailable before getting Lay1 indication(as we agreed). So it is natural that the old configuration of TRS (all the TRS resource set groups) become unavailable.  Understanding 2-2 is just optimization and add complexity for the UE which is not preferred. |
| ZTE | Understanding 2-1 | We understand the 2-1 is more reasonable, if we go for understanding 1, it means UE always blindly stop monitoring the TRS whenever receiving the SIB change notification regardless of the notification is for SIB17 or not.  In addition, from NW perspective, the intention of introducing L1 validity indication is to avoid the modification of SIB17 during the validity period, so we think it is mostly like that no modification of SIB17 will be occurred before validity timer is expired. If we go for understanding 1, it will deviate the intention of L1 validity period. |
| Intel | Understanding 1 | Our understanding is that SIB changes are supposed to be quite infrequent. If this is still the assumption, we also don’t think we need to over optimise with Understanding 2. Understanding 1 is simple and straightforward. |
| Sequans | Understanding 1 | Understandings 2 leave an undefined time between the end of the MP where the SI change notification was received and the time the new configuration is received. Since SI change should be rare, understanding 1 should be enough. |
|  |  |  |

Summary:

9 companies provided inputs to this question.

- Understanding 1: 4 companies (LGE, Huawei, Intel, Sequans)

- Understanding 2-1: 4 companies (CATT, vivo, Xiaomi, ZTE)

Ericsson clearly state they don’t support understanding 1, and suggest capturing in the specification that the validity duration is only valid while the UE has a valid SIB17, which is essentially what vivo and CATT were thinking would be the assumed UE implementation with understanding 2-1.

Since no company supports understanding 2-2, it can be ruled out:

**Proposal 1 (9/9): The UE behavior where UE the UE terminates the validity duration of a TRS configuration at the time it receives the updated SIB17, if updated, and only for the TRS configuration that has changed, is not pursued.**

Now for the two leftover options, there is not enough majority in either side to select an option.

From rapporteur’s perspective, the current specification reads:

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| ***trs-ResourceSetConfig***  RS configuration of TRS occasion(s) for idle/inactive UE(s), in terms of a list of N>=1 NZP TRS resource set(s). The maximum number of TRS resource sets configured by higher layer is 64. If a TRS resource is configured, the L1 based availability indication is always enabled based on that configuration. A UE which acquired SIB-17 with a TRS configuration but did not yet receive an associated L1-based availability indication considers the configured TRS as unavailable. |

The above highlighted sentence does not mandate that the associated L1-based availability indication must be received after UE acquired SIB17, and so can be interpreted as: any L1-based availability indication associated with an *indBitID* can be assumed still valid for a new TRS configuration acquired later in SIB17, with the same *indBitID*. Which is what companies unanimously wanted to avoid in Phase 1.

So rapporteur suggests checking further the complexity of both options (I’ve used the clean version of the on-going draft CR, for readability).

Spec impact of understanding 1:

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| --- |
| ***trs-ResourceSetConfig***  RS configuration of TRS occasion(s) for idle/inactive UE(s), in terms of a list of N>=1 NZP TRS resource set(s). The maximum number of TRS resource sets configured by higher layer is 64. If a TRS resource is configured, the L1 based availability indication is always enabled based on that configuration. A UE which acquired SIB-17 with a TRS configuration but did not yet receive an associated L1-based availability indication considers the configured TRS as unavailable. A UE which received a SI change notification considers its configured TRS(s) as unavailable from the modification period boundary until it receives the associated L1-based availability indication(s). |

Spec impact of understanding 2-1:

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| --- |
| ***trs-ResourceSetConfig***  RS configuration of TRS occasion(s) for idle/inactive UE(s), in terms of a list of N>=1 NZP TRS resource set(s). The maximum number of TRS resource sets configured by higher layer is 64. If a TRS resource is configured, the L1 based availability indication is always enabled based on that configuration. A UE which acquired SIB-17 with a TRS configuration but did not yet receive an associated L1-based availability indication considers the configured TRS as unavailable. A UE which acquired SIB-17 after receiving a SI change notification considers its configured TRS(s) as unavailable until it receives the associated L1-based availability indication(s). |

Then, considering:

1. both options have equivalent impact, complexity-wise, on the specification;
2. the new condition brought by understanding 2-1 is similar to the existing condition that UE already checks upon acquiring SIB17, while understanding 1 imposes a new specific UE behavior at the modification boundary;
3. understanding 2-1 has higher performance;

it can be observed that understanding 2-1 provides a better performance for a lower UE complexity and equivalent specification impact. Therefore rapporteur suggests moving forward with understanding 2-1.

**Proposal 2 (4 vs 4): RAN2 adopts understanding 2-1 i.e.: UE considers the validity duration for all TRS resource set groups is ended when UE receives the changed TRS/CSI-RS configuration in the modification period following a SI change notification or until the validity time duration expires, whichever is earlier.**

# Conclusion

Based on the above discussion, it is proposed to agree the following phase 2 conclusions:

Easy agreement:

**Proposal 1 (9/9): The UE behavior where UE the UE terminates the validity duration of a TRS configuration at the time it receives the updated SIB17, if updated, and only for the TRS configuration that has changed, is not pursued.**

Discuss on-line:

**Proposal 2 (4 vs 4): RAN2 adopts understanding 2-1 i.e.: UE considers the validity duration for all TRS resource set groups is ended when UE receives the changed TRS/CSI-RS configuration in the modification period following a SI change notification or until the validity time duration expires, whichever is earlier.**

# Reference

1. [R2-2204809](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_118-e/Docs/R2-2204809.zip) Discussion on TRS availability when SI change, vivo

1. [R2-2204908](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_118-e/Docs/R2-2204908.zip) TRS/CSI-RS configuration in RRC\_CONNECTED, DENSO

1. [R2-2206046](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_118-e/Docs/R2-2206046.zip) TRS and CSI-RS exposure, Ericsson