**3GPP TSG RAN WG1 Meeting #108-e** **R1-xxxxxxx**

**e-Meeting, February 21-March 3, 2022**

**Agenda Item: 8.13.2**

**Source: Moderator (Huawei)**

**Title:** **[Draft] Summary of efficient SCell activation/de-activation mechanism of NR CA**

**Document for: Discussion and Decision**

# Introduction

As per chairman’s guidance, two rounds with check points below are planned. This summary is for the first round and is expected to complete by **March 3**.

[108-e-NR-DSS-02] Email discussion for maintenance on efficient activation/de-activation mechanism – Frank (Huawei)

* 1st check point: February 25
* Final check point: March 3

There are **two GTW sessions scheduled as below, on Tuesday (22nd) and Thursday (24th)**.



According to the contribution papers under agenda item 8.13.2 for efficient activation/de-activation mechanism for NR CA SCells, all identified issues are summarized in Section 2 and can be discussed in Section 3.

# Summary of issues and priorities

According to all of companies’ contribution documents, all the issues are summarized below, including 5 specific issues and 1 general issues, with more details in Section 3. Please companies provide your views in Section 3 with taking into consideration the information of check points and GTW session.

For the specific issues to activation/deactivation process:

* **Issue-1:** Reply LS on RAN2 agreements for TRS-based Scell activation
* **Issue-2:** TP for [TS 38.214]
* **Issue-3:** TP for [TS 38.300]
* **Issue-4:** QCL configuration of temporary RS
* **Issue-5:** Enhancement for CSI reporting

For general issues, they are mostly extracted from a proposal of one company:

* **Question G1:** Whether fast SCell activation is applicable to SCell on unlicensed band?

According to the contribution papers, companies’ top interests and focus seem to be the LS on RAN2 agreements for TRS-based Scell activation and TP for [TS 38.214]. Therefore, the following discussion order is suggested. Besides any issue is always welcome for any comment, but the first check point and the potential GTW session could focus more on some issues as listed. If any issue reaches potential early consensus based on companies’ feedbacks, it is also surely reviewed by its earliest check point.

## Schedule

* For GTW session February 24, and 1st check point: February 25
* **Issue-1: Reply LS on RAN2 agreements for TRS-based Scell activation.**
* **Issue-2: TPs for [TS 38.214].**
* **Issue-3: TP for [TS 38.300].**
* For final check point: March 3, and potential new GTW session
* **Follow-ups for all issues listed in 1st check point**
* **Issue-4: QCL configuration of temporary RS**
* **Issue-5: Enhancement for CSI reporting**
* **The remaining issues with potential consensus**

In case of different views or suggestions on the schedule, they are welcome here.

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| *Company* | *View* |
| vivo | We are generally fine with the schedule, but we prefer to also discuss the G1 in first round as this is a new issue that was not discussed before. |
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# Discussions

## Issue-1: Reply LS on RAN2 agreements for TRS-based Scell activation.

In the LS [12] (copied in Appendix as well), RAN2 has finalized the design for temporary RS triggering **based on Alt 1**, including the MAC CE design and RRC configuration. RAN2 respectfully asks RAN1 to consider RAN2’s agreements, question and corresponding RRC CR and MAC CR.

Additionally, a question for RAN1 is asked as below,

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| **Q1: RAN2 would like to confirm whether RAN2’s understanding is correct and whether there is any limitation in TRS configuration for fast SCell activation in Rel-17 which needs to be captured in RAN2 spec?** |

**Issue 1.1: Whether RAN2’s understanding that the trs-info in NZP-CSI-RS-ResourceSet will be set to TRUE if the CSI-RS for tracking is the temporary RS for fast SCell activation is correct****?**

**Opt 1.1.1:** RAN2’s understanding is correct. [1] [2] [8] [9] [10] [11] [15] [16]

#### FL proposal

With above summary, a proposal is provided as below

***FL Proposal 1-1****: Confirm the RAN2 understanding in Q1 of the LS R1-2200890.*

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | OK |
| OPPO | Ok with the intention. But given there is still pending issue for triggering offset, RAN1 may want to make it clear that above confirmation only apply to RAN2 understanding on trs-info, instead of their whole CRs. ***Proposal 1-1****: Confirm the RAN2 understanding in Q1 of the LS R1-2200890 for trs-info.* |
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**Issue 1.2: Whether there is any limitation in TRS configuration for fast SCell activation in Rel-17 which needs to be captured in RAN2 spec?**

* **Limitation 1.2.1:** CSI-RS can only be configured on a BWP with firstActiveDownlinkBWP-Id.[2]
* **Limitation 1.2.2:** CSI-RS for tracking for fast SCell activation cannot be one with two NZP CSI-RS resources in one slot. [2] [8]

**Which limitation(s) above is necessary?**

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | Neither.The first one is reflected in the RAN2 draft 38.331 CR. The second one is captured in RAN1 spec 38.214, which is clear enough. |
| OPPO | We understand the question is what limitation should be informed to RAN2, instead of what is necessary or not. RAN1 could reply RAN2 to inform Limitation 1.2.2 above, and meanwhile to tell them this is already reflected in RAN1 spec CR.  |
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**Issue 1.3: Comments on MAC CR [13] provided by RAN2.**

* **Comment 1.3.1:** For 38.321, the terminology “TRS (CSI-RS for tracking)” is confusing for fast SCell activation and is not recommended. [8]

**Whether the potential comment can be included in the reply LS to RAN2?**

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | No. We don’t think this should be discussed in RAN1 – this is a RAN2 spec writing issue (if it is really an issue).Companies can directly propose a better terminology in RAN2. |
| OPPO | This should be a RAN2 discussion.  |
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**Issue 1.4: Comments on RRC CR [14] provided by RAN2.**

* **Issue 1.4.1:** CSI-RS resources within one CSI-RS resource set for TRS should be configured with the same TCI state in RRC CR. [2][4]

As described in the RAN1 spec, the resources in one resource set in a temporary RS have the same QCL relation/TCI state ID. Therefore, companies propose that the temporary RS does not need a sequence of TCI state IDs to define its QCL information as done in the current TS 38.331 CR.

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| CR R2-2201714 for TS 38.331***SCellActivationRS-Config* information element**-- ASN1START-- TAG-SCELLACTIVATIONRS-CONFIG-STARTSCellActivationRS-Config-r17 ::= SEQUENCE { scellActivationRS-Id-r17 SCellActivationRS-ConfigId-r17, resourceSet-r17 NZP-CSI-RS-ResourceSetID, gapBetweenBursts-r17 INTEGER (2..31) OPTIONAL, -- Need R qcl-Info-r17 ~~SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StateId,~~ TCI-StateId, ...}-- TAG-SCELLACTIVATIONRS-CONFIG-STOP-- ASN1STOP |

For the above issue and proposed change, companies’ views are very welcome.

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| *Company* | *View* |
| vivo | We think the draft CR can work without the proposed modification (e.g., by simply providing one TCI state). But we are also fine to the change if majority prefer to modify. |
| OPPO | Same view as vivo. Additionally, should the qcl-Info-r17 field be OPTIONAL? At last, it is our understanding that RAN1 only provides RAN2 with RRC parameter recommendation, but CR to RAN2 spec.  |
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* **Issue 1.4.2:** Indicate the triggering offset for temporary RS transmission by introducing new parameter or reusing parameter *aperiodicTrrggeringOffset* inRRC CR. [11]

**Which alternative is preferred?**

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | We prefer to reuse the existing parameter (which seems to be the intention of the original proposed Alt.1). |
| OPPO | We suggest to reuse the parameter name “*aperiodicTrrggeringOffset*”, but this “*aperiodicTrrggeringOffset*” can have a different value interpretation (in 38.331) when the parameter is used in fast SCell activation configuration (or when the configuration is used for fast SCell activation).  |
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* **Issue 1.4.3:** Informs RAN2 by LS that *aperiodicTriggeringOffset-r16* for triggering offset of temporary RS in RRC CR should be defined as in section 5.2.1.5.3 of TS 38.214. [5]

The current “*aperiodicTriggeringOffset-r16*” in 38.331 is defined as the offset between the slot holding the triggering DCI and the slot where the temporary RS is transmitted, as following:

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| ***TS 38.331 text:*** ***aperiodicTriggeringOffset, aperiodicTriggeringOffset-r16***Offset X between the slot containing the DCI that triggers a set of aperiodic NZP CSI-RS resources and the slot in which the CSI-RS resource set is transmitted. For *aperiodicTriggeringOffset*, ……. For *aperiodicTriggeringOffset-r16*, the value indicates the number of slots. The network configures only one of the fields. When neither field is included, the UE applies the value 0. |

However, reference slot agreed in RAN1 for temporary RS is k slots after the triggering DCI. Therefore, existing description of “*aperiodicTriggeringOffset-r16*” in TS 38.331 does not match the RAN1 intention for triggering offset of temporary RS. Company proposes that RAN1 should inform RAN2 to refine the description of the RRC parameter.

**Whether the clarification is needed and how to clarify it?**

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | We don’t see a strong need for this modification. We can clarify it in RAN1 spec (38.214) if necessary. |
| OPPO | We believe the clarification is needed. RAN1 should clarify in RRC parameter list sent to RAN2 or in a reply LS that “***aperiodicTriggeringOffset***” has a new meaning as matching RAN1 agreement, if RAN1 prefers to have a RAN1 TP as provided in Issue-2.1. If “***aperiodicTriggeringOffset***” still follows its legacy interpretation in RAN2 spec CR, there seems no need to define “reference slot” for UE to determine where to receive TRS -- when to receive TRS is completely determined by when to receive the triggering MAC-CE plus “***aperiodicTriggeringOffset***”.  |
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## Issue-2: TPs for [TS 38.214]

Most of the functionalities related to aperiodic CSI-RS for fast SCell activation have been captured in the RAN1 and RAN2 specs. Some further clarification in specs seem necessary and companies’ views are summarized below.

Relevant excerpts from TS 38.214 are as follows:

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| 5.1.6.1.1.1 Aperiodic CSI-RS for fast SCell activationA UE can be configured with aperiodic CSI-RS resources for tracking for an SCell for fast SCell activation using *NZP-CSI-RS-ResourceSet(s)* with the higher layer parameter [*TRSforScellActivation-List*], with the QCL relation as with aperiodic CSI-RS for tracking in clause 5.1.6.1.1.Each CSI-RS resource, defined in clause 7.4.1.5.3 of [4, TS 38.211], for fast SCell activation is configured by the higher layer parameter *NZP-CSI-RS-Resource* with the same restrictions as defined for CSI-RS for tracking in clause 5.1.6.1.1. |

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| 5.2.1.5.3 Aperiodic CSI-RS for tracking for fast SCell activationWhen the UE receives an activation MAC-CE that triggers one or two CSI-RS bursts for fast SCell activation for a (set of) deactivated SCell(s),- if the MAC-CE indicates that the first CSI-RS burst for SCell activation is present in an SCell, then the UE may assume that the first CSI-RS burst for SCell activation is present in that SCell. The first slot of the first CSI-RS burst starts at the *m1*th SCell slot after the last SCell slot coinciding with the reference slot *n+k*, as defined in clause 4.3 of [6, TS38.213], of the cell in which the MAC-CE was received.- if the MAC-CE indicates that the second CSI-RS burst for SCell activation is present in an SCell, then the UE may assume that the second CSI-RS burst for SCell activation is present in that SCell. The first slot of the second CSI-RS burst starts at the *m2*thSCell slot after the end of the first CSI-RS burst. The CSI-RS of the second burst shall have the same antenna port index, OFDM symbol allocations in a slot, same PRB allocation location as the CSI-RS of the first burst.- Where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots in clause 5.1.6.1.1.1, and *m1* and *m2* are provided by the MAC-CE and higher layer configuration. |

* **Issue 2.1:** Clarify that m1 and m2 correspond to parameters *aperiodicTriggeringOffset* and *gapBetweenBursts*, respectively in clause 5.2.1.5.3. [4] [9]

Companies propose that parameters m1 and m2 in RAN1 specification should be clarified. Example TP is as follows.

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| 5.2.1.5.3 Aperiodic CSI-RS for tracking for fast SCell activation==================== unchanged parts ====================- Where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots in clause 5.1.6.1.1.1, and *m1* and *m2* are provided by the MAC-CE and higher layer configurationaccording to *aperiodicTriggeringOffset* and *gapBetweenBursts,* respectively.==================== unchanged parts ==================== |

For the above change, companies’ views are very welcome.

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| *Company* | *View* |
| vivo | We are fine to clarify it in RAN1 spec.  |
| OPPO | As pointed out in our contribution and Issue 1.4.3, “*aperiodicTriggeringOffset*” in the current RAN2 CR still points to the legacy interpretation, i.e., the delay between when TRS is transmitted and when the triggering command is transmitted. But the RAN1 agreement implies such triggering offset should be relative to reference slot. So it seems better to firstly handle Issue 1.4.3.  |
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* **Issue 2.2:** Change “activation MAC CE” to “Enhanced SCell Activation/Deactivation MAC CE” in clause 5.2.1.5.3. [3]

Given that there are multiple MAC CEs for SCell activation, the current TS 38.214 is not clear on which MAC CE is used to trigger the TRS. The following TP is provided to address this issue.

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| 5.2.1.5.3 Aperiodic CSI-RS for tracking for fast SCell activationWhen the UE receives an *Enhanced SCell Activation/Deactivation MAC CE* ~~activation MAC-CE~~ that triggers one or two CSI-RS bursts for fast SCell activation for a (set of) deactivated SCell(s),==================== unchanged parts ==================== |

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | Support |
| OPPO | This is an editorial issue that can be fully handled by editor. The spec looks ok even without this change.  |
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* **Issue 2.3:** Change “[*TRSforScellActivation-List*]” to “*scellActivationRS-ConfigToAddModList*” in clause 5.1.6.1.1. [3] [8]

According to the RAN2 CR provided in [14], the RRC parameter in TS 38.214 should be updated. Example TP is as follows.

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| 5.1.6.1.1.1 Aperiodic CSI-RS for fast SCell activationA UE can be configured with aperiodic CSI-RS resources for tracking for an SCell for fast SCell activation using *NZP-CSI-RS-ResourceSet(s)* with the higher layer parameter *scellActivationRS-ConfigToAddModList* ~~[~~*~~TRSforScellActivation-List~~*~~]~~, with the QCL relation as with aperiodic CSI-RS for tracking in clause 5.1.6.1.1.==================== unchanged parts ==================== |

For the above change, companies’ views are very welcome.

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| *Company* | *View* |
| vivo | Support |
| OPPO | Ok. But still, this can be handled by editor when doing batch sync to 38.331 definitions.  |
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* **Issue 2.4:** Exception for temporary RS for fast SCell activation should be clear. [8]

As described in [8], for legacy TRS, additional bandwidths of CSI-RS resource can be configured if the UE indicates an optional capability signalling *trs-AdditionalBandwidth* (only for 10MHz FDD carrier with 15kHz). However, this should not mean that a UE indicating *trs-AdditionalBandwidth* supports the additional CSI-RS bandwidths for temporary RS for fast SCell activation. The company thinks that there will be a spec impact and corresponding TP is proposed as follows.

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| 5.1.6.1.1.1 Aperiodic CSI-RS for fast SCell activation[…]Each CSI-RS resource, defined in clause 7.4.1.5.3 of [4, TS 38.211], for fast SCell activation is configured by the higher layer parameter *NZP-CSI-RS-Resource* with the same restrictions as defined for CSI-RS for tracking in clause 5.1.6.1.1~~.~~, except for the following:* if carrier $N\_{grid}^{size,μ}=52$, $N\_{BWP,i}^{size}=52$, $μ=0$ and the carrier is configured in paired spectrum, the bandwidth of the CSI-RS resource, as given by the higher layer parameter *freqBand* configured by *CSI-RS-ResourceMapping*, is *X* resource blocks, where $X \geq 28$ resources if the UE indicates [FG35-2, set1] *~~trs-AddBW-Set1~~* for the [FG35-2] *~~trs-AdditionalBandwidth~~* capability and $X \geq 32$ if the UE indicates [FG35-2, set2] *~~trs-AddBW-Set2~~*for the [FG35-2] *~~AdditionalBandwidth~~* capability; in these cases, if the UE is configured with CSI-RS comprising X<52 resource blocks, the UE does not expect that the total number of PRBs allocated for DL transmissions but not overlapped with the PRBs carrying CSI-RS for tracking is more than 4, where all CSI-RS resource configurations shall span the same set of resource blocks; otherwise, the bandwidth of the CSI-RS resource, as given by the higher layer parameter *freqBand* configured by *CSI-RS-ResourceMapping*, is the minimum of 52 and $N\_{BWP,i}^{size}$ resource blocks, or is equal to $N\_{BWP,i}^{size}$ resource blocks. For operation with shared spectrum channel access, *freqBand* configured by *CSI-RS-ResourceMapping*, is the minimum of 48 and $N\_{BWP,i}^{size}$ resource blocks, or is equal to $N\_{BWP,i}^{size}$ resource blocks.

[…] |

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | We are open to discuss this topic, and would like to understand the motivation, e.g., in which case a UE can support *AdditionalBandwidth* for tracking TRS, but not for fast Scell activation? |
| OPPO | We are open to further discuss, especially concerning the UE behavior in the potential case where the CSI-RS for tracking and temp-RS for fast SCell activation can fully overlap in time (which can be a multi-use of the same transmitted signal from gNB point of view).  |
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* **Any other views on any TP for [TS 38.214]?**

If any, companies’ views are very welcome.

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## Issue-3: TP for [TS 38.300]

For the Rel-17 efficient SCell activation of NR CA, the objective of TRS based SCell activation is **led by RAN1**. TP on stage 2 description for Rel-17 efficient SCell activation in TS 38.300 is needed in RAN1.

* **Proposal 3.1**: Endorse the below TP on stage 2 description for Rel-17 efficient SCell activation of NR CA in TS 38.300. [17]

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| ----------------------------------------------- *TP* *start*------------------------------------------------10.6 Activation/Deactivation Mechanism==== *Unchanged parts* ====The dormant BWP is one of the UE's dedicated BWPs configured by network via dedicated RRC signalling. The SpCell and PUCCH SCell cannot be configured with a dormant BWP.To enable fast SCell activation when CA is configured, TRS for SCell activation can be configured for an SCell to assist AGC and time/frequency synchronization. A MAC CE is used to trigger activation of one or more SCell(s) and trigger the TRS on each of them.==== *Unchanged parts* ====----------------------------------------------- *TP* *end* ------------------------------------------------ |

**The TP is expected to be endorsed in RAN1 then sent to RAN2 by a LS**.

For the TP above, companies’ views are very welcome.

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| *Company* | *View* |
| vivo | We are fine to have a stage2 description. But specifically for this TP, it seems “TRS” is something never defined in 300? |
| OPPO | We would rather suggest to leave RAN2 to decide whether/how to capture fast SCell triggering mechanism in 38.300, because the current section 10.6 of 38.300 does not seem to even mention the legacy SCell activation signaling mechanism (i.e., something based on SSB and the legacy MAC-CE). So adding Rel-17 TRS and new MAC-CE may read a bit strange.  |
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## Issue-4: QCL configuration of temporary RS

The QCL source of temporary RS were discussed in last meeting and agreements have been achieved in the case of known SCell. Some remaining problems about QCL mechanism can be further clarified.

* **Opt 4.1:** Temporary RS can be used as the Type-A QCL source for CSI RS used for valid CSI reporting during SCell activation. [7]
* **Opt 4.2:** SSB of one of the active cells can be indicated as a QCL source for temporary RS for the case of unknown SCell, at least in the case of intra-band continuous CA. [6]
* **Opt 4.3:** No need for further discussion.

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | Opt 4.3.It seems other options are actually new features/enhancements, not maintenance issues. |
| OPPO | Opt 4.1. One basic purpose for setting up a temp-RS is to promptly provide time synchronization information to UE’s processing. We wonder why Opt 4.1 should be disallowed. Meanwhile, we are open whether Opt 4.1 should be explicitly reflected in spec.  |
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## Issue-5: Enhancement for CSI reporting

TCSI\_reporting reduction may be beneficial to achieve efficient SCell activation. Companies’ views are summarized as follows:

* **Opt 5.1:** The new MAC CE introduced for temporary RS triggering can additionally indicate CSI reporting based on temporary RS for activated SCells. [11]
* **Opt 5.2:** gNB can schedule the UE with PDSCH immediately after the first CSI reporting including CQI or RSRP feedback based on TRS employed for fast SCell activation. [11]
* **Opt 5.3:** The UE should consider the MAC-CE activation of a SCell as a trigger for a preconfigured SP-CSI reporting for that cell. [11]
* **Opt 5.4:** Short interval P/SP- CSI-RS report. [7][11]
* **Opt 5.5:** Remove TCSI\_reporting for the case of FR2 unknown cell. [7][11]
* **Opt 5.6:** No further optimization.

**Question:** **Which options above of CSI reporting enhancement should be supported?**

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | Opt 5.6.It seems other options are actually new features/enhancements, not maintenance issues. |
| OPPO | Opt 5.6.  |
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## General Issues

**Question G1:** Whether fast SCell activation is applicable to SCell on unlicensed band? [3]

*“It is not clear whether the UE can expect that TRS is present in the symbols indicated by MAC CE for the SCell on unlicensed band. Therefore, it is proposed to clarify whether fast SCell activation is applicable to SCell on unlicensed band.”*

*“Proposal 1: RAN1 should clarify whether fast SCell activation is applicable to SCell on unlicensed band.”*

Companies’ views are very welcome.

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| *Company* | *View* |
| vivo | In the case of SCell on an unlicensed band, the TRS may not be present due to channel access failure. A UE does not monitor PDCCH for a deactivated SCell, and may not be able to monitor because AGC/tracking has not yet been done for the deactivated SCell, thus it cannot detect whether the channel access for TRS is successful or not. Consequently, it is not clear whether the UE can expect that TRS is present in the symbols indicated by MAC CE for the SCell on unlicensed band.Thus, we think RAN1 should clarify whether fast SCell activation is applicable to SCell on unlicensed band. Considering that this issue has not been discussed before, maybe the simplest way is to conclude that this feature is not applicable. |
| OPPO | There has been no RAN1 discussion on how to handle “listen-before-talk” for temporary RS which is triggered by an earlier MAC-CE with specifically given delay. So our understanding is that Rel-17 should not assume fast SCell activation can be applicable to unlicensed band. On the other hand, such clarification may not necessarily have spec impact - a RAN1 conclusion should be enough.  |
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## Other Issues

Issues or comments that do not fit in any of the previous sections of this document can be provided in this section.

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# Conclusions

# References

1. R1-2200915 Discussion on efficient activation/de-activation mechanism for SCells Huawei, HiSilicon
2. R1-2200997 Support efficient activation/de-activation mechanism for Scells FUTUREWEI
3. R1-2201119 Remaining issues on efficient activation/de-activation mechanism for Scells vivo
4. R1-2201175 Maintenance of Efficient Activation De-activation Mechanism for SCells in NR CA ZTE
5. R1-2201299 Discussion on efficient activation/de-activation for SCell OPPO
6. R1-2201500 Discussion on efficient activation deactivation mechanism for Scells NTT DOCOMO, INC.
7. R1-2201936 Remaining issues on efficient activation and de-activation mechanism for SCell in NR CA Xiaomi
8. R1-2202164 Efficient activation/de-activation mechanism for SCells in NR CA Qualcomm Incorporated
9. R1-2202222 Maintenance for efficient SCell activation Ericsson
10. R1-2202271 On RAN2 LSs to RAN1 on TRS-based SCell activation Nokia, Nokia Shanghai Bell
11. R1-2202354 Discussion on fast and efficient SCell activation in NR CA LG Electronics
12. R1-2200890/R2-2201715, “LS on RAN2 agreements for TRS-based Scell activation”.
13. R2-2201713, “38321 CR Introduction of TRS based SCell activation”.
14. R2-2201714, “38331 CR Introduction of TRS based SCell activation”.
15. R1-2201039, Draft reply LS on TRS-based Scell activation vivo
16. R1-2201153, Reply LS on RAN2 agreements for TRS-based Scell activation ZTE
17. R1-2202465, TP on stage 2 description for Rel-17 efficient SCell activation of NR CA Huawei, HiSilicon

# Appendix: LS R1-2200890

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| 1 Overall descriptionRAN2 discussed MAC CE and RRC signalling for TRS based SCell activation and made the following agreements.* Use alt1 with one octet used for TRS ID (including gap length if not configured by RRC).

The MAC CR and RRC CR for TRS based SCell activation are attached in this LS.In RAN2’s understanding, the *trs-info* in *NZP-CSI-RS-ResourceSet* will be set to TRUE if the CSI-RS for tracking is the temporary RS for fast SCell activation.**Q1: RAN2 would like to confirm whether RAN2’s understanding is correct and whether there is any limitation in TRS configuration for fast SCell activation in Rel-17 which needs to be captured in RAN2 spec?**2 Actions**To RAN1:**RAN2 respectfully asks RAN1 to consider the above RAN2 agreements, question and corresponding RRC CR and MAC CR. |

# Appendix: Agreements

All agreements and received LS’s can be found in [R1-2112904](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_107-e/Docs/R1-2112904.zip).

Some of them are listed below for convenience.

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| Agreements:As working assumption, with respect to efficient SCell activation, reuse existing Rel-15/16 TRS structure for temporary RS* FFS: how many burst/symbols are required for both AGC settling and Time/Frequency tracking for different cases, e.g. FR1 and FR2, known and unknown SCell
	+ A burst of temporary RS is notated as in S5.1.6.1.1 of TS 38.214
		- “2-slot with four CSI-RSs resources (4 samples)” for FR1
		- either “1-slot with two CSI-RSs resources (2 samples)” or “2-slot with four CSI-RSs resources (4 samples)” for FR2
* The working assumption can be confirmed after RAN4 check. (A LS for such request is planned).

Agreements:For efficient SCell activation, discuss and agree from the following alternatives at RAN1#104-e* Alt 1: the trigger of temporary RS is integrated into a single triggering signaling with the trigger of SCell activation transmitted on an activated cell.
	+ FFS detailed design of this integrated triggering signaling.
	+ Potential examples of single triggering signaling for further discussions
	+ A PDSCH TB, e.g. containing two respective MAC-CEs for both triggers, one MAC-CE for both triggers
	+ A DCI for both triggers
	+ A PDSCH TB and its scheduling DL grant, e.g. MAC-CE for activation and DL grant for temporary RS
	+ A DL grant and a UL grant received in the same slot/OFDM symbols of PDCCH where the DL grant is scheduling a MAC-CE for SCell activation and the UL grant is triggering the RS.
	+ Rel-15/16 SCell activation MAC-CE and a specific configuration of temporary RS being implicitly triggered as well
* Alt2: Triggering of temporary RS separately from SCell activation command is not precluded and both ‘separate’ triggers (examples below) and ‘integrated’ triggers (examples in Alt 1) are considered for SCell activation
	+ FFS detailed design of separate triggering signaling.
	+ Potential examples of separate triggering signaling for further discussions
	+ Rel-15/16 SCell activation MAC-CE and Rel 15/16 DCI triggering
	+ Rel-15/16 SCell activation MAC-CE and new DCI triggering for temporary RS
* Note: temporary RS should be triggered by DCI or MAC-CE.
* Note: the final mechanism of trigger signaling targets at applicability to one or more SCell activation.
* FFS handling of  SCell activation by existing Rel15/16 CA activation command when temporary RS is configured and triggered/not triggered

**Working Assumption**At least for the case of known cell, temporary RS is supported to expedite the activation process during the SCell activation procedure for efficient SCell activation for both FR1 and FR2:* The temporary RS should provide at least the functionalities of AGC settling and time/frequency tracking during SCell activation procedure.
* FFS potential functionalities of CSI measurement/acquisition and cell search

Agreements:TRS is selected as temporary RS for Scell activation         If more functionalities are confirmed to be supported by temporary RS, other RS candidates, e.g. aperiodic CSI-RS, P/SP-CSI RS, SRS and RS based on SSS/PSS, are not precluded.         The TRS should be triggered by DCI or MAC-CE. FFS which exact triggering command.  Agreements:UEs measure the triggered temporary RS during Scell activation procedure no earlier than a slot m:         FFS timeline values m which may need coordination with RAN4.         FFS if the triggered temporary RS can be associated with a BWP, then the measurement above is independent of the activation state of the BWP.Agreements:Companies are encouraged to provide design details of temporary RS next meeting, at least including:* TRS structure, e.g. whether to fully reuse existing Rel-15/16 TRS structure and configuration restriction (refer to S5.1.6.1.1 of TS 38.214), or any modification
* QCL information, if any
* Triggering command: DCI format/fields or MAC-CE fields
* Triggering timeline/scheduling offset

**Working Assumption**For efficient SCell activation with assistance of temporary RS, a SSB of the to-be-activated SCell can be indicated as a QCL source for the temporary RS in case of known SCell* FFS: QCL type
* FFS: the case of unknown SCell
* FFS: other QCL source, e.g. the SSB/P-TRS of another active cell

**Agreement**For efficient activation of SCells,down select at least one option from below:* Option 1a: MAC CE(s) contained in a single PDSCH to trigger both SCell activation and corresponding temporary RS(s)
	+ Details FFS including timeline design for receiving temporary RS
* Option 1b: A single DCI to trigger both SCell activation and corresponding temporary RS(s)
	+ Details FFS including potential impact on SCell activation related procedures and, e.g. timeline design for SCell activation and for receiving temporary RS
	+ FFS: The same DCI for SCell deactivation
* Option 2: A Rel-15/16 SCell activation MAC-CE to trigger SCell activation and a Rel-15/16 DCI to trigger corresponding temporary RS(s) with enhancement of timeline
	+ Details FFS including timeline design for receiving a DCI trigger of temporary RS, and for receiving temporary RS
* Note: Companies are encouraged to provide complete solutions for fast SCell activation.
* Note: the previous agreement on the definitions of Alt 1 and Alt 2 is still effective

**Agreement**For efficient activation of SCells* Option 1a: MAC CE(s) contained in a single PDSCH to trigger both SCell activation and corresponding temporary RS(s)
	+ Details FFS including timeline design for receiving temporary RS

Note: Separate from the support of Option 1a, it is up to RAN4 whether or not to consider an activation time enhancement for Option 2 without requiring further RAN1 work* Option 2: A Rel-15/16 SCell activation MAC-CE to trigger SCell activation and a Rel-15/16 DCI to trigger corresponding Rel-15/16 A-TRS(s)

Send an LS to RAN4. The LS is endorsed in R1-2104110.AgreementFor efficient activation of Scells, the triggered temporary RS is aperiodic.AgreementFor efficient activation of a Scell (in known Scell case), at least the number of temporary RS bursts is indicated by a field in new MAC-CE* The number of temporary RS bursts is RRC configurable.
* FFS: which field in MAC-CE is used and how this field is associated with the number of bursts
* For the purpose of designing temporary RS Scell activation, there is no RAN1 specification impact for the case where the number of indicated temporary RS bursts is smaller than what is expected by the UE

AgreementTo trigger temporary RS for efficient activation of SCells, the contents of the triggering MAC-CE(s) in a single PDSCH provide at least the following information (explicitly or implicitly):* Whether or not temporary RS is triggered
* FFS detailed Information of temporary RS, e.g.:
	+ Resources used for triggered Temporary RS
	+ Triggering time offset of triggered Temporary RS
	+ QCL source for triggered Temporary RS
* FFS: Detailed signalling structure of the triggering MAC-CE(s) including the down-selection between the following example options and whether the decision should be made in RAN1 or RAN2
	+ Opt. 1.1: One new MAC CE for both SCell activation triggering and corresponding temporary RS triggering
	+ Opt. 1.2: One R15/16 SCell activation MAC CE for SCell activation triggering and one new MAC CE (in the same PDSCH) for corresponding temporary RS triggering

AgreementFor efficient activation of a Scell (in known Scell case), the triggering offset of temporary RS is indicated by a field in new MAC-CE* The candidate value(s) of triggering offset(s) is RRC configurable
* FFS: which field in MAC-CE is used and how this field is associated with the value of triggering offset

AgreementFor the reference slot for triggering offset of temporary RS* Option 2: the last DL slot of the to-be-activated Scell overlapping with slot n+k as defined in 38.213 sub-clause 4.3
* FFS: the earliest slot no earlier than the reference slot for a UE to receive a triggered temporary RS

AgreementIf a UE measures a temporary RS triggered by a MAC-CE during SCell activation procedure, the measurement is performed within the BWP bandwidth of BWP indicated by *firstActiveDownlinkBWP-Id*Agreement For efficient SCell activation, the earliest slot for a UE to receive a triggered temporary RS is the reference slot (i.e., the last DL slot of the to-be-activated Scell overlapping with slot n+k as defined in 38.213 sub-clause 4.3).ConclusionFor the purpose of designing temporary RS for Scell activation, RAN1 will not discuss for the case where a gNB may assume the to-be-activated SCell with assistance of temporary RS is a known SCell for a UE but it is actually unknown SCell from the UE side during the SCell activation duration.AgreementFor to-be-activated SCell, if any BWP ID is configured as part of temporary RS(s) configuration, the value of the BWP ID is expected to be equal to *firstActiveDownlinkBWP*-Id;Agreement To trigger temporary RS, * MAC-CE at least provides the following information:
	+ temporary RSs are to be triggered on X out of Y (Y≥X) to-be-activated SCells, respectively, while no temporary RS is to be triggered on the other to-be-activated SCells.
* The following information can be provided by RRC for temporary RS for each SCell
	+ The number of RS bursts and the gap length between the RS bursts (Opt 2.3.3)
	+ Triggering offset of temporary RS (Opt 2.3.4)
		- ~~Triggering offset can be provided, e.g., by reusing existing CSI-RS framework~~
	+ QCL information (Opt 2.3.5)
		- ~~Triggering QCL information can be provided, e.g., by reusing existing CSI-RS framework~~
	+ ~~A unique temporary RS configuration index~~
	+ FFS: the maximum number of temporary RS per cell/per UE

Note: Reusing A-TRS triggering framework is not precluded.* Information for 0, 1, or more temporary RS can be provided for each configured SCell

Agreement* For triggering temporary RS, down-select based on the following alternatives, or let RAN2 be aware the status of this discussion
	+ Alt 1: Bitmap approach in MAC-CE ~~similar to SCell activation~~
		- Every Z-bit block in the bitmap corresponds to a SCell, Z>=0
		- A Z-bit block indicates the temporary RS [configuration index], and a value zero indicated by the bit block means no RS resource transmitted.
		- The to-be-activated SCell is indicated via the C values in the legacy SCell activation/de-activation MAC CE or in the new MAC-CE
	+ Alt 2: Reuse A-TRS triggering framework
		- A trigger state is indicated by the MAC-CE explicitly
		- The association between a trigger state and ~~aperiodic~~ temporary RS for one or multiple SCells is configured by RRC according Rel-16 A-TRS triggering framework
			* ~~SCell ID is configured as a part of the temporary RS configuration. Some SCell IDs derived from the trigger state triggered by the new MAC-CE may not refer to to-be-activated SCells that are indicated by the new MAC-CE or the legacy SCell activation/de-activation MAC-CE~~
		- FFS: The value zero of the MAC-CE indication means no temporary RS is triggered by the MAC-CE for all to-be-activated SCells
	+ Note: The down-selection targets at a RAN1 consensus on MAC-CE functionality and the list of RRC parameters for this feature. Any MAC-CE signaling design above are reference concept, its final MAC-CE signaling design is up to RAN2.

Agreement* Provide the functionality to be fulfilled, as well as the status about the understanding on Alt 1 and Alt 2, which could be provided by examples (including respective possible RRC parameters, if agreed, required by Alt 1 and Alt 2) to facilitate RAN2’ understanding.
* Send LS to ask RAN2 to consider the following alternatives and finalize the MAC-CE or RRC signalling design, including parameters.
* RAN1 only needs to focus on RRC parameters examples, if needed.
* ~~List of RAN1 endorsed RRC parameters for this issue will not be sent to RAN2~~

Alt 1: Bitmap approach in MAC-CE * Every Z-bit block in the bitmap corresponds to a SCell, Z>=0
* A Z-bit block indicates the temporary RS [configuration index], and a value zero indicated by the bit block means no RS resource transmitted.
* The to-be-activated SCell is indicated via the C values in the legacy SCell activation/de-activation MAC CE or in the new MAC-CE

Alt 2: Reuse A-TRS triggering framework* A trigger state is indicated by the MAC-CE explicitly
* The association between a trigger state and temporary RS for one or multiple SCells is configured by RRC according Rel-16 A-TRS triggering framework
* FFS: The value zero of the MAC-CE indication means no temporary RS is triggered by the MAC-CE for all to-be-activated SCells

AgreementThe detailed signaling structure of the triggering MAC-CE(s) including the down-selection between the following options is left to RAN2 to decide:         Opt. 1: One new MAC CE for both SCell activation triggering and corresponding temporary RS triggering         Opt. 2: One R15/16 SCell activation MAC CE for SCell activation triggering and one new MAC CE (in the same PDSCH) for corresponding temporary RS triggering AgreementIf two temporary RS bursts are configured, both bursts share the same antenna port index, OFDM symbol location and PRB location of CSI-RS resources in a slot or CSI-RS resources in two consecutive slots.**Agreement***The max number of NZP CSI-RS resource set configurations for temporary RS per serving cell is the same as current maxNrofNZP-CSI-RS-ResourceSetsPerConfig.***Agreement***For efficient SCell activation with assistance of temporary RS, a ~~SSB~~ P-TRS of the to-be-activated SCell is to be configured as a QCL source for the temporary RS in case of known SCell same as existing specification.** *Note: a SSB of the to-be-activated SCell is a QCL source for the P-TRS per existing specification*
* *Note: It is RAN1 understanding that Scell activation latency can be reduced compared to Rel-16 even when P-TRS is configured as QCL source for the temporary RS in case of known SCell*

Below Working Assumption does not need to be confirmed.**Working Assumption**For efficient SCell activation with assistance of temporary RS, a SSB of the to-be-activated SCell can be indicated as a QCL source for the temporary RS in case of known SCell* FFS: QCL type
* FFS: the case of unknown SCell
* FFS: other QCL source, e.g. the SSB/P-TRS of another active cell

Agreement(for reference during the discussion)* For triggering temporary RS, down-select based on the following alternatives, or let RAN2 be aware the status of this discussion
	+ Alt 1: Bitmap approach in MAC-CE ~~similar to SCell activation~~
		- Every Z-bit block in the bitmap corresponds to a SCell, Z>=0
		- A Z-bit block indicates the temporary RS [configuration index], and a value zero indicated by the bit block means no RS resource transmitted.
		- The to-be-activated SCell is indicated via the C values in the legacy SCell activation/de-activation MAC CE or in the new MAC-CE
	+ Alt 2: Reuse A-TRS triggering framework
		- A trigger state is indicated by the MAC-CE explicitly
		- The association between a trigger state and ~~aperiodic~~ temporary RS for one or multiple SCells is configured by RRC according Rel-16 A-TRS triggering framework
			* ~~SCell ID is configured as a part of the temporary RS configuration. Some SCell IDs derived from the trigger state triggered by the new MAC-CE may not refer to to-be-activated SCells that are indicated by the new MAC-CE or the legacy SCell activation/de-activation MAC-CE~~
		- FFS: The value zero of the MAC-CE indication means no temporary RS is triggered by the MAC-CE for all to-be-activated SCells
	+ Note: The down-selection targets at a RAN1 consensus on MAC-CE functionality and the list of RRC parameters for this feature. Any MAC-CE signaling design above are reference concept, its final MAC-CE signaling design is up to RAN2.

***Agreement****For both Alt 1 and Alt 2 of temporary RS triggering,** *For Alt 1, the gap between temporary RS bursts is explicitly configured.*
* *A set of possible gap lengths from which the triggering MAC-CE can indicate one from RAN1 perspective. Up to RAN2 to decide details.*
* *For Alt 2, a gap length is configured by RRC for each temporary RS having two bursts. For different temporary RS, the value of the gap length can be different based on RRC configuration.*
* *the number of bursts is up to 2. It can be either explicitly configured, or implicitly indicated by the gap configuration ((Up to RAN2 to decide one)*

 ***Agreement****For Alt 2 of temporary RS triggering, to avoid potential impact on the existing CSI-AperiodicTriggerStateList, a separate trigger-state list is used.** *Note: it does not imply that Alt 2 has been selected by RAN2.*

 ***Agreement****For the RRC and MAC-CE designs of temporary RS triggering (both Alt1 and Alt2), from functionality perspective, the max number of to-be-activated SCells should be 15, irrespective of triggered number of temporary RS bursts per cell.*        *Note: UE capability for the max number of to-be-activated SCells with 2-burst temporary RS is not precluded.* |