**3GPP TSG RAN WG1 Meeting #107-e** **R1-211xxxx**

**e-Meeting, November 11th-19th, 2021**

**Agenda Item: 8.13.2**

**Source: Moderator (Huawei)**

**Title:** **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 October 14.

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

* 1st check point: November 15
* Final check point: November 19

According to the contribution papers under agenda item 8.13.2 for efficient activation/de-activation mechanism for NR CA SCells, and in light of the working assumption and agreements achieved the previous meetings, all identified issues are summarized in section 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:** Contents for the triggering signaling
* **Issue-2:** QCL configuration of temporary RS
* **Issue-3:** Enhancement for CSI reporting
* **Issue-4:** Collision handling with uplink slot/symbols

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

* **Question G1:** Whether the P-TRS burst and/or SSB transmitted during the temporary RS based activation should be considered to handle? [2]
* **Question G2:** Whether UE should provide feedback to the gNB on the status of SCells upon the reception of MAC CE SCell activation command in which more than one SCell is requested for activation? [4]

Regarding Question G2, as concluded in RAN1#106-e, there seems no need to further discuss this case**. If majority companies have interest on it, please let us know.**

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| Conclusion  For 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. |

According to previous discussions, companies’ top interests and focus seems to be the QCL configuration and contents for the triggering signaling. 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 1st check point: November 15

Note: The following first two issues have impacts on details of TRS and potential LS request to RAN4

* **Issue-1: Contents for the triggering signaling**
* **Issue-2: QCL configuration of temporary RS**
* For 2nd check point: November 19, and potential new GTW session
* **Follow-ups for all issues listed in 1st check point**
* **Issue-4: Collision handling with uplink slot/symbols**
* **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* |
| ZTE | We agree with the schedule shared by FL above. |
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# Discussions

In current specifications, when a UE receives a SCell activation command in a PDSCH in slot , the UE shall complete SCell activation no earlier than and no later than slot *n*+ [*THARQ* + *Tactivation\_time* + *TCSI\_Reporting*]/ as shown in Figure 1. Therefore, reducing *THARQ*, *Tactivation\_time* and *TCSI\_Reporting* is the key to achieve efficient SCell activation/de-activation mechanism. Companies’ views are summarized in the sections below. In addition to your feedback to Section 3, more detailed comments are welcome.



Figure 1 SCell activation procedure

## THARQ reduction

### Issue-1: Contents for the triggering signaling

**Issue 1.1: What contents should be** **explicitly indicated in MAC CE?**

Multiple contents should be explicitly or implicitly indicated in new MAC CE. **The chairman urges the discussion on the content of MAC CE signaling indication**, as it would be very helpful for RAN2 signaling implementation if RAN1 could provide a list of contents that are recommended to be explicitly indicated by the new MAC CE. Since the discussion of MAC CE is coupled with the discussion of RRC parameters, it would be better to discuss it here.

**Question 1.1-1: How** **to indicate** **the gap between two temporary RS bursts?**

* **Opt 1.1.1:** explicitly indicated in MAC CE per SCell based on Alt1. [1]
* **Opt 1.1.2:** configured by RRC signaling. [3]
* **Opt 1.1.3:** implicitly indicated by the value difference of configured *aperiodicTriggering-Offset* for each burst, whose value range [0..31] is unchanged.

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | Our understanding is Option 1.1.2, i.e., the gap is configured by RRC signaling for each TRS resource set.  Since in last RAN1 meeting, it has been agreed that two bursts share the same time-frequency configuration, in this case, only one TRS resource set is needed. 4 TRS resources are configured in this resource set, which correspond to the four symbols of one burst. Then a gap is configured for this TRS resource set. The gap together with the aperiodicTriggering-Offset, the time location for the second burst can be derived.  For Option 1.1.3, since the aperiodicTriggering-Offset is configured at TRS resource set level, it means network has to configure multiple TRS resource set for TRS bursts, which will unnecessarily increase the signaling overhead.  Option 1.1.1 may increase the MAC-CE overhead. Besides, the motivation to support this kind of higher flexibility even than Rel-15 aperiodic TRS triggering is not clear from our perspective. |
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**Question 1.1-2: any other content of MAC-CE indication?**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | From our perspective, only one triggering state index is sufficient for this MAC-CE.  The following contents can be configured by RRC signaling.  1. Gap between two bursts.  2. Number of bursts. See more explanation in next question. |
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**Issue 1.2: How to indicate the number of temporary RS bursts?**

* **Opt 1.2.1:** explicitly configured by RRC signaling. [3]
* **Opt 1.2.2:** implicitly indicated by the presence of the gap between temporary bursts since one gap can be used to indicate two bursts.
* **Opt 1.2.3:** explicitly indicated in MAC CE per SCell based on Alt1.

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | Our understanding is Opt 1.2.1.  We understand that companies may argue that the gap can be implicitly used to indicate that two bursts are needed. However, RAN4 only says 2 bursts are needed, it doesn’t preclude network to indicate more bursts to increase the robustness. Furthermore, Opt 1.2.1 is also future proof if more bursts are needed for other cases, e.g., for known cases. |
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**Issue 1.3: For Alt2, whether a separate *CSI-AperiodicTriggerStateList* for MAC-CE triggered temporary RS is needed？**

* **Opt 1.3.1:** yes. [14]
* **Opt 1.3.2:** yes if existing Rel16 A-CSI-RS trigger state list is deemed insufficient. [13]

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | We support to have a separate CSI-AperiodicTriggerStateList for MAC-CE triggered temporary RS.  The TRS may be limited to 4 symbols within 2 slots and the QCL may also have some potential updates, it would be better to support separate CSI-AperiodicTriggerStateList to avoid the potential impact to the existing CSI-AperiodicTriggerStateList design. |
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**Issue 1.4: For temporary RS triggering (both Alt1 and Alt2), from functionality perspective, whether the max number of to-be-activated SCells triggered with 2-burst temporary RS should be 8 or 15?**

With Opt 1.1.3 (under issue 1.1), the max number of to-be-activated SCells that are triggered with 2-burst temporary RS is limited to 8 because the max size *maxNrofReportConfigPerAperiodicTrigger* of the list *associatedReportConfigInfoList* in a triggered state is only 16 and 8 SCells with 2 bursts have fully occupied all of them. It seems a restriction of functionality considering that **2 bursts are required in most of cases according to RAN4 reply LS R1-2104170.**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | It is true that Opt 1.1.3 under issue 1.1 may have some limitation. However, Opt 1.1.2 (gap is explicitly indicated in RRC) under issue 1.1 can avoid this issue.  It is true that the max size maxNrofReportConfigPerAperiodicTrigger of the list associatedReportConfigInfoList in a triggered state is 16. However, for Opt 1.1.2, only one TRS resource set is needed for two bursts because the two bursts share the same time-frequency-spatial configuration, it is unnecessary to configure two TRS resource sets for them. Thus, 16 Cells (actually it should be 15 SCells) can be triggered all together. |
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**Issue 1.5: For temporary RS triggering (both Alt1 and Alt2), from functionality perspective, whether the max number of resource configurations per serving cell of temporary RS should be 4, 8, 16 or any other value?**

It could be 16 which is the same value as current *maxNrofNZP-CSI-RS-ResourceSetsPerConfig*, the max number of NZP-CSI-RS resource sets per *CSI-ResourceConfig*. **This number has impact on RAN2 design of MAC-CE signaling and RRC signaling, thus RAN1 should inform it to RAN2**.

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | For Alt.2, we think the legacy number can be kept. For Alt.1, it may impact the MAC-CE overhead, a smaller number may be more appropriate. |
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## Tactivation reduction

### Temporary-RS based

#### Issue-2: QCL configuration of temporary RS

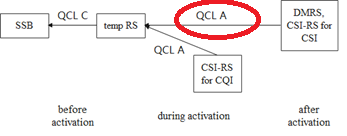
**Issue-2.1: For the case of known SCell, what is the QCL mechanism for Rel-17 SCell activation?**

In last meeting, extensive discussions on QCL relations involving aperiodic TRS based temporary RS were provided. QCL mechanism associated with temporary RS before / during / after the activation should be clarified separately at least for known SCell. Three sub issues can be discussed.

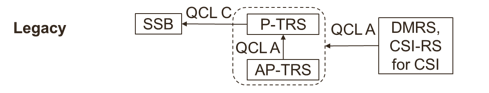
**Issue 2.1.1: whether the working assumption “For efficient SCell activation with assistance of temporary RS, a SSB of the to-be-activated SCell can be indicated as a QCL source for the temporary RS in case of known SCell” should be confirmed?**

* **Opt 2.1.1.1:** confirm,temporary RS is QCLed with SSB. [1][3][4][5][8][9][11]
* **Opt 2.1.1.2:** temporary RS is QCLed with a periodic TRS. [2][14][10]

**Please kindly note that** it could have impact on the QCL chain between temporary RS and its following PDCCH DMRS/CSI-RS, as shown in the following figure. Because a UE should be informed which configured P-TRS arrived after the temporary RS should be considered for the handling of DMRS and CSI-RS.



In the legacy A-TRS case, since the A-TRS is always associated with a P-TRS by its QCL source, the UE is well informed how to utilize P-TRS along with the A-TRS for the handling of DMRS and CSI-RS.



**Question 2.1-1:** **What the QCL source of temporary RS should be? Without associated P-TRS, how would a UE know when and which configured P-TRS can be utilized for DMRS and CSI-RS?**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | Our understanding is Opt 2.1.1.1.  The SSB is the QCL source for temporary RS for known SCells according to the previous working assumption.  From our perspective, the association of P-TRS and A-TRS (temporary RS) can be removed at least during the SCell activation procedure. In this case, UE doesn’t need to utilize P-TRS.  After SCell activation, the legacy UE behavior is resumed including the association between P-TRS and A-TRS. This can be left to network implementation, e.g., network indicate the legacy P/A-TRS (instead of the temporary RS) as the QCL source for DMRS and CSI-RS. |
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**Issue 2.1.2: Whether the tracking information obtained from the temporary RS during SCell activation can be used by a UE as QCL information to perform CSI reporting?**

* **Opt 2.1.2.1:** Yes. [1][2][5][8][10]
* **Opt 2.1.2.2:** The tracking information of Temporary RS is valid until the first periodic CSI-RS for tracking has been transmitted. [4]
* **Opt 2.1.2.3:** Temporary RS doesn’t seem to be appropriate as QCL source for other RS. [11]

For Opt 2.1.2.2, more clarification from proponents are encouraged. For example, how does a UE know which one of configured periodic CSI-RSs is involved in the validation of a given temporary RS? Is it the same way as the discussion point of issue 2.1.1 so that the A-TRS is valid until the first associated P-TRS arrives after it?

For Opt 2.1.2.3, it is encouraged to elaborate the reason and concerns.

**Question 2.1-2:** **Whether tracking information acquired from the temporary RS during the activation can be used as QCL source for CSI reporting?**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | Our understanding is Opt 2.1.2.1, based on our understanding, the A-TRS (temporary RS) can already be indicated as QCL source for CSI-RS by existing specification. No spec change is needed. |
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**Issue 2.1.3:** **Whether the tracking information obtained from temporary RS can be used as QCL information for DMRS and CSI-RS reception after SCell activation?**

* **Opt 2.1.3.1:** Yes. [1][2][5][10]
* **Opt 2.1.3.2:** No. [11]

**Question 2.1-3: Whether the tracking information obtained from temporary RS can be used as QCL information for DMRS and CSI-RS reception after SCell activation?**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | We would prefer not, i.e., Opt 2.1.3.2.  However, we can also leave this issue to network implementation without any spec change. With the existing specification, network can already indicate A-TRS as QCL source for DMRS and CSI-RS. UE can just follow network configuration and indication. |
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**Issue-2.2: For the case of unknown SCell, whether SSB of one of the active cells can be indicated as a QCL source for temporary RS?**

* **Opt 2.2.1:** Yes, at least for intra-band CA. [4][2]
* **Opt 2.2.2:** Yes. [1]
* **Opt 2.2.3:** No need for further optimizations. [5][9]

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | From our perspective, some initial view/feasibility from RAN4 for this issue is needed. |
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## TCSI\_reporting reduction

### Issue-3: Enhancement for CSI reporting

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

* **Opt 3.1** The new MAC CE introduced for temporary RS triggering can additionally indicate CSI reporting based on temporary RS for activated Scells. [11]

*“CSI reporting based on temporary RS could be triggered simultaneously in the NEW MAC CE which will be introduced to trigger temporary RS of to-be-activated SCells. Since it is redundant to introduce additional MAC CE exclusively for CSI reporting based on temporary RS, it would be better to design so that temporary RS triggering and CSI reporting can be instructed simultaneously through the same MAC CE. Furthermore, it is worth to note that CSI reporting is not always triggered automatically when the MAC CE indicates temporary RS reception. So, through this MAC CE, temporary RS triggering and CSI reporting can be indicated separately. For example, both of temporary RS triggering and CSI reporting are indicated for some SCells, while only TRS triggering is indicated but CSI reporting is not indicated for other SCells.”*

* **Opt 3.2** 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. [4]
* **Opt 3.3** The UE should consider the MAC-CE activation of a SCell as a trigger for a preconfigured SP-CSI reporting for that cell. [4]
* **Opt 3.4** short interval P/SP- CSI-RS report. [1]

“*Short periodicity P-CSI-RS and P-CSI-RS reporting for low latency SCell activation can reduce uncertainty time in acquiring the first available downlink CSI reference resource or uncertainty in acquiring the first available CSI reporting resources in TCSI\_Reporting.*”

* **Opt 3.5** remove TCSI\_reporting for the case of FR2 unknown cell. [1]

“*During the procedure of SCell activation, when gNB receives the beam reporting, i.e. the L1-RSRP report, it implies that UE has completed beam selection and timing synchronization which are necessary conditions for downlink transmission. It means that gNB can start downlink transmission with a conservative or rough MCS on the SCell, and UE can start to monitor PDCCH on the SCell, even the valid CSI report is not yet reported. Thus the gNB and UE can assume the SCell is activated after the Tactivation\_time.*”

* **Opt 3.6** No further optimization (e.g., by reusing the temporary RS for CSI measurement) is needed to reduce the CSI reporting time for efficient SCell activation. [5]

**Question 3:** **which options above of CSI reporting enhancement should be supported?**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | At this late stage, we would suggest to focus on the existing remaining issues for fast SCell activation instead of pursuing new optimizations. Thus, Opt 3.6 is our preference. |
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## Issue-4: Collision handling with uplink slot/symbols

Collision handling with uplink slot/symbol was raised in last meeting and some companies think that this issue should be discussed. Companies’ views are summarized as follows:

* **Opt 4.1:** no need to specify additional UE behavior. [5][9][1]
* **Opt 4.2:** handled by scheduling restriction, temporary RS cancellation and temporary RS delay. [6]

**Question 4: which options above of collision handling with uplink slot/symbols should be supported?**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | As long as the gap between bursts and triggering offset can be configured by RRC and/or indicated by MAC-CE, this issue can be avoided by network implementation. |
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## General Issues

**Question G1:** Whether the P-TRS burst and/or SSB transmitted during the temporary RS based activation should be considered to handle? [2]

*“During the new activation procedure based on temporary RS,* *it may just so occur that a P TRS burst and/or SSB is also sent according to the pre-configured periodicity/offset*. *In principle, the AGC/time tracking/frequency tracking functionalities can be done based on a temporary RS, a P TRS burst, and/or SSB, but the UE implementation may become too complicated as there can be many different combinations of how the temporary RS, P TRS, and SSB appear. In addition, the UE may follow the legacy activation procedure using the SSB or the new procedure using the temporary RS.”*

*“It is needed to clearly define the UE behavior or at least the requirement of activation time in these cases.”*

“*Proposal 5:* *Discuss and decide on how to handle P TRS burst and/or SSB transmitted during the temporary RS based activation.”*

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | We think it can be up to UE’s implementation. If UE considers the P-TRS and SSB can facilitate its SCell activation procedure, UE can handle them by implementation. |
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**Question G2:** Whether UE should provide feedback to the gNB on the status of SCells upon the reception of MAC CE SCell activation command in which more than one SCell is requested for activation? [4]

*“To ensure reliable and fast SCell activation the serving cell would benefit from UE feedback on which SCells are in known vs unknown state so it can re-act accordingly.”*

*“If upon SCell activation the UE could provide feedback, via L1 or L2 regarding the SCells it can activte with reduced latency, this would allow the serving cell to react faster to the needs and potentially also save the overhead of sending temp RS which the UE would not be able to employ.”*

*“Proposal 7: Downselect and option for early UE feedback on which SCells the UE plans to activate: 1) feedback is early L1 HARQ-ACK codebook based or 2) early CQI reporting.”*

Companies’ views are very welcome.

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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. [R1-2110797](C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2110797.zip) Discussion on efficient activation/de-activation mechanism for SCells Huawei, HiSilicon

1. [R1-2110884](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2110884.zip) Support efficient activation/de-activation mechanism for Scells FUTUREWEI

1. [R1-2110925](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2110925.zip) Discussion on Support Efficient Activation De-activation Mechanism for SCells in NR CA ZTE

1. [R1-2110945](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2110945.zip) On low latency Scell activation Nokia, Nokia Shanghai Bell

1. [R1-2111044](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2111044.zip) Remaining issues on efficient activation/de-activation mechanism for Scells vivo

1. [R1-2111347](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2111347.zip) Discussion on efficient activation/de-activation for Scell OPPO
2. [R1-2111520](file:///C:\Users\h00604508\AppData\Local\Docs\R1-2111520.zip) On efficient activation/de-activation for SCells Intel Corporation

1. [R1-2111554](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2111554.zip) Discussion on efficient activation and de-activation mechanism for SCell in NR CA Xiaomi

1. [R1-2111765](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2111765.zip) Remaining Issues on Scell Activation/Deactivation Samsung

1. [R1-2111901](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2111901.zip) On efficient SCell Activation/Deactivation Apple

1. [R1-2112068](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2112068.zip) Discussion on fast and efficient SCell activation in NR CA LG Electronics
2. [R1-2112132](file:///C:\Users\h00604508\AppData\Local\Docs\R1-2112132.zip) Discussion on efficient activation deactivation mechanism for Scells NTT DOCOMO, INC.

1. [R1-2112155](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2112155.zip) Reduced Latency SCell Activation Ericsson

1. [R1-2112243](file:///C:\\Users\\h00604508\\AppData\\Local\\Docs\\R1-2112243.zip) Efficient activation/de-activation mechanism for SCells in NR CA Qualcomm Incorporated

# Appendix: Agreements

A summary of agreements and received LS till RAN1#106b-e can also be found in R1-2110697.

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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.  Agreement  For efficient activation of Scells, the triggered temporary RS is aperiodic.  Agreement  For 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   Agreement  To 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   Agreement  For 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   Agreement  For 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   Agreement  If 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).  Conclusion  For 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.  Agreement  For 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   Agreement  The 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    Agreement  If 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. |