**3GPP TSG RAN WG1 Meeting #106-e [R1-2108317]**

**e-Meeting,** **August 16th – 27th, 2021**

**Agenda Item: 8.13.2**

**Source: Moderator (Huawei)**

**Title: Summary#1 of efficient SCell activation/de-activation mechanism of NR CA**

**Document for: Discussion and Decision**

# Introduction

As per chairman’s guidance, three rounds with check points below are planned. This summary is for the first round and is expected to complete by August 19.

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

* 1st check point: August 19
* 2nd check point: August 24
* Final check: August 27

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 last meeting, 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 7 specific issues and 3 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:** Triggering signaling for SCell activation/de-activation and temporary RS
* **Issue-3:** Scenarios for temporary-RS based SCell activation
* **Issue-4:** Earliest slot for triggered temporary RS
* **Issue-5:** QCL configuration of temporary RS
* **Issue-6:** Tactivation reduction with BS assistance but no temporary RS nor SSB
* **Issue-7:** Enhancement for CSI reporting

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

* **Question G1:** If two temporary RS bursts are transmitted, whether both bursts should employ the same temporary RS configuration? [9]
* **Question G2:** Whether the UE should provide the gNB information of which configured SCells or SCells being activated are able to benefit from fast activation and/or the need for temporary RS? [9]
* **Question G3**: Whether or not to additionally support AP CSI-RS, P/SP CSI-RS, SRS, and RS based on SSS/PSS as temporary RS, one or more of which may be used during SCell activation depends on network configuration / UE capability. [6]

According to previous discussions, companies’ top interests and focus seems to be the detailed designs of temporary RS. 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: August 19, and GTW session on August xx

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

* **Issue-1: Contents for the triggering signaling**
* **Issue-2: MAC-CE signaling for SCell activation/de-activation and temporary RS**
* **Issue-3: Scenarios for temporary-RS based SCell activation**
* **Issue-4: Earliest slot for triggered temporary RS**
* **Issue-5: QCL configuration of temporary RS**
* For 2nd check point: August 24, and potential new GTW session
* **Follow-ups for all issues listed in 1st check point**
* **The remaining issues with potential consensus**

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

|  |  |
| --- | --- |
| *Company* | *View* |
| ZTE | Support the above prioritization. |
| Qualcomm | The FL proposal is reasonable. Just a minor comment on this summary; Section 3.1 is titled as “THARQ reduction”, but there is no discussion point to reduce THARQ in the section. We recommend to rename it as, e.g., “MAC-CE design for triggering temporary RS”. |
| Futurewei | We asked to clarify the BWP issue in our tdoc. For now we added it in Sec. 3.5 Other Issues. But we think this is important to clarify.We suggest to resolve the issue of potentially misaligned understanding of known/unknown SCell soon, treating it in parallel with the first few issues for the 1st check point, especially if RAN1 needs input from RAN4. |
| Xiaomi | Support FL’s suggestion. |
| Moderator | @Qualcomm, thank you for your check and suggestion, it is reflected.@all, your comments on the BWP issue raised by Futurewei are welcome here. We may add it as additional issue to be discussed this meeting. Its potential outcome could be reformed as a proposal,***Potential proposal:****If any BWP ID is configured within the configuration of temporary RS(s), the value of the BWP ID is expected to be equal to firstActiveDownlinkBWP-Id;* |
| vivo | We are fine to further clarify the BWP agreement to make it clear. |
| MTK | Support FL’s suggestion. Fine with the potential proposal on the BWP issue raised by Futurewei. |
| NTT DOCOMO | Support FL’s suggestion. |
| Intel | Support FL’s suggestion. |

# Discussions

In current specifications, when a UE receives a SCell activation command in a PDSCH in slot $n$, the UE shall complete SCell activation no earlier than $n+k$ and no later than slot *n*+ [*THARQ* + *Tactivation\_time* + *TCSI\_Reporting*]/$T\_{slotlength}$ 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 SCell activation procedure

## THARQ reduction

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

**Issue 1-1: What contents should be indicated in MAC CE**

**A list of potential contents for the signaling is provided below in addition to what was agreed in the last meeting,**

* Resources used for triggered Temporary RS [1][4][7][8][10][12][14][15]
* Triggering time offset of triggered Temporary RS[1][2][3][4][5][7][8][10][13][14][15]
* QCL source for triggered Temporary RS [1][4][5][7][8][10][12][14][15]

***FL Proposal****: 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):*

* *Resources used for triggered Temporary RS*
* *Triggering time offset of triggered Temporary RS*
* *QCL source for triggered Temporary RS*

**Question 1.1: whether the FL proposal is ok?**

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| ZTE | Based on our understanding, the existing aperiodic triggering state can be reused. All the three listed bullets can already be configured by RRC now. If we go with the above proposal, we may end up with discussing all the potential parameters, which is not efficient for discussion. In this sense, we suggest to first have a proposal to reuse the aperiodic triggering state configuration and only discuss what needs to be additionally configured or indicated. |
| Qualcomm | In general, the FL proposal should be fine. On top of that, we think it is more important to discuss and agree detailed configurations/triggering design for temporary RS. In particular, RAN1 should review the existing CSI-RS configuration/triggering framework and try to reuse it as much as possible for temporary RS configuration/triggering. From our point of view, there is no need to change the existing ASN/1 structure to support temporary RS configuration/triggering. |
| Futurewei | Generally ok with the FL proposal, and agree with Qualcomm’s comment that existing signaling (RRC, MAC, or even DCI field design) should be reused as much as possible. It would be better to describe what ‘explicitly/implicitly’ means here (explicitly in MAC CE / implicitly from RRC or spec).We also suggest to revisit the QCL source bullet after some QCL agreements have been achieved. |
| Xiaomi | We share the same views with ZTE/Qualcomm/Futurewei. The current NZP A-CSI-RS triggering mechanism should be reused as much as possible. The only difference between temporary RS triggering and A-CSI RS triggering is that the dynamic signaling, i.e. MAC CE is used for temporary RS and DCI is used for A-CSI RS. We are supportive to the statement that the listed information in the proposal is necessary for temporary RS triggering, but they should be implicitly indicated from RRC signaling and should not be included in MAC CE explicitly. |
| Spreadtrum | We are fine the proposal, and agree with ZTE that it is important to figure out what is new comparing with A-CSI triggering state. |
| vivo | RAN1 already agreed to indicate the triggering offset in MAC CE in previous meeting, thus no need of the second bullet:AgreementFor efficient activation of a Scell (in known Scell case), the triggering offset of temporary RS is indicated by a field in new MAC-CEWe are open to consider the other two bullets. |
| MTK | Share the same view as Xiaomi. |
| NTT DOCOMO | We are fine the proposal, and agree that it is important to discuss whether/what modification from the existing CSI-RS triggering mechanism is needed. |
| Intel | For the triggering offset and QCL source, we prefer to indicate it explicitly by MAC so that to allow more freedom. For remaining parameters, it is preferred to reuse the framework of A-CSI RS configuration, but with MAC CE triggering.  |

**Issue 1-2: what fields are explicitly indicated in MAC CE**

Multiple contents should be explicitly or implicitly indicated in new MAC CE. For example, the triggering offset of temporary RS can be either explicitly indicated in the new MAC CE or implicitly derived from a pre-configured list of RS resources and a RS resource ID indicated in the new MAC CE. **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.** Therefore, what fields are explicitly indicated in MAC CE should be discussed, companies’ views are summarized as follows:

* Opt 2.3.1: Target SCell ID [4]
* Opt 2.3.1A: triggering information (e.g. trigger state ID/trigger RS ID/ entry index) [1][4][8][9][13][14][15]
* Opt 2.3.2: Whether or not temporary RS is triggered [1][3]
* Opt 2.3.3: The number of RS bursts and the gap length between the RS bursts [3]
* Opt 2.3.4: Triggering offset of temporary RS [10]
* Opt 2.3.5: QCL information [10]

**Question 1.2: what fields are explicitly indicated in MAC CE?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| ZTE | Since there are two Opt 2.3.1above, I volunteer to update the second one to Opt 2.3.1A. From our perspective, at least Opt 2.3.1 and Opt 2.3.1A are needed. Option 2.3.3, 2.3.4 and 2.3.5 can already be indicated in the RRC configuration. |
| Qualcomm | Opt.2.3.1A (updated by ZTE). |
| Futurewei | For Opt.2.3.1A, generally it should be explicit, but that depends on the number of triggering states. If there is only one or if there is a default configured, then explicit signaling in MAC CE is not needed. Opt. 2.3.2 may be incorporated into this.For Opt. 2.3.3, it may again depend on the design. The combinations of #bursts+gap may be mapped to codepoints / triggering states via RRC configuration, and hence this may also be incorporated into Opt. 2.3.1A.For Opt. 2.3.4 and 2.3.5, they can be in RRC configuration as done in existing mechanism.Again we’d like to point out that at least for some cases, all the fields can be pre-configured and even the legacy MAC CE can be used to trigger temporary RS with default configuration. |
| Xiaomi | Option 2.3.1A. Maybe the index can be further improved as option 2.3.1 and option 2.3.1A are parallel options. |
| Spreadtrum | Opt 2.3.1A+ Opt 2.3.2Trigger state ID is most preferred. In addition, whether or not temporary RS is triggered in Opt 2.3.2, and the number of RS bursts and the gap length between the RS bursts in Opt 2.3.3 can be outside of Trigger state ID or within its configuration can be further discussed. |
| vivo | We are not sure if there is common understanding on the meaning of “explicitly indicated in MAC CE”. Anyway, such kind of detailed design of MAC signaling is RAN2’s responsibility and should be up to RAN2. |
| MTK | Opt 2.3.1: NeededOpt 2.3.1A: NeededOpt 2.3.2: Needed (Not sure why other companies think not)Opt 2.3.3: Needed, isn’t current RRC configuration can not trigger TRS with more than two bursts?Opt 2.3.4: Not needed, can be indicated in the RRC configurationOpt: 2.3.5: Not needed, can be indicated in the RRC configuration (however, spec needs to additionally specify that SSB can be QCL source for A-TRS for fast SCell activation) |
| NTT DOCOMO | At least Option 2.3.1 and Option 2.3.1A. For Option 2.3.1, SCell ID can be SCell index or bitmap for multiple SCells. |
| Intel | Does Opt 2.3.1 mean the SCell indication in existing MAC CE for SCell activation?Opt 2.3.1A are necessary in MAC CE. Opt 2.3.4 can be in MAC CE which give more freedom to control the timing of temporary RS facilitating the resource sharing among UEsWe are fine to configure QCL information as one parameter of temporary RS by RRC  |

### Issue-2: MAC-CE signaling for SCell activation/de-activation and temporary RS

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, companies’ views are summarized as follows:

* Opt. 2.1: One new MAC CE for both SCell activation triggering and corresponding temporary RS triggering. [1][3][4][11][12][13]
* Opt. 2.2: 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
* Opt. 2.3: Depend on RAN2’ decision [2][3][5][10][14][15]

***FL Proposal****: For 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*

**Question 2: whether the above proposal is ok?**

Companies’ views are very welcome.

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| *Company* | *View* |
| ZTE | Our preference is Opt.1 and we support to try down-selection in this RAN1 meeting. If no convergence in RAN1, we are also ok to leave it to RAN2. In any case, Opt.2 also needs to define a new MAC-CE and RAN2 may need to specify potential relation between the MAC-CE for SCell activation triggering and new MAC-CE for the temporary RS, which unnecessarily complicates the specification design. |
| Qualcomm | RAN1 should spend more on what to be indicated by the MAC-CE. RAN1 does not need to agree the MAC-CE structure; RAN2 can decide by themselves once the details of what to be indicated by the MAC-CE are clear. |
| Futurewei | We are open to Opt. 2.1, 2.2, and 2.3.We suggest to add a note to the proposal for triggering the default temporary RS:*NOTE: One R15/16 SCell activation MAC CE for SCell activation triggering and for corresponding default temporary RS triggering* |
| Xiaomi | We are OK with the proposal. RAN1 should determine what functionality is needed in order to support temporary RS triggering while the detail MAC CE design is up to RAN2. There is no big difference between option 1 and option 2 in our view. |
| Spreadtrum | We support the proposal. |
| vivo | We are fine with the FL proposal. |
| MTK | Same view with ZTE. Prefer Opt.1 but ok to leave it to RAN2. |
| NTT DOCOMO | We support Opt.1, but if there is no consensus in RAN1, we are fine to leave it to RAN2. |
| Intel | Agree with Qualcomm that RAN1 should just decide the information to be included in MAC CE. The exact signaling structure is RAN2 expertise.  |

## Tactivation reduction

### Temporary-RS based

#### Issue-3: Scenarios for temporary-RS based SCell activation

Based on previous discussions, there has been confusion on the applicable scenarios for SCell fast activation, such as known cell / unknown cell scenarios. Two scenarios are specified by RAN4 in TS 38.133， which represent respectively whether a to-be-activated Scell is known or unknown. An issue whether the gNB and UE have the same understanding of a to-be-activated SCell being known or not has been discussed in RAN1. Particularly, regarding the information indication of number of temporary RS bursts, the following agreement was achieved.

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

For the other indicated information, companies’ views are summarized as follows:

* Opt. 3.1.1: No RAN1 specification impact for number of temporary RS burst and QCL assumption. It is expected that two different requirements of activation latency are developed in RAN4 for both cases of known SCell and unknown SCell, respectively. [1][14]
* Opt. 3.1.2: Support both cases of known SCell and unknown SCell, with conservative design for cases in which the SCell has not been used for more than x ms, and FFS x; [6]
* Opt. 3.1.3: Send an LS to RAN4 to inquire whether the gNB and UE can have the same understanding on the state of a to-be-activated SCell with respect to being known SCell or unknown SCell.[6][9]

**Question 3: how to clarify the understanding of known/unknown SCell in RAN1?**

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| ZTE | Our understanding is that, RAN1 doesn’t need to clarify the understanding of known and unknown SCell in RAN1 specification. RAN1 can always refer it to RAN4 spec. However, if majority companies would prefer to go with Opt 3.1.3, we are also ok. |
| Qualcomm | The question is not clear. RAN1 does not need to take care of whether the SCell is known/unknown. According to the RAN4 LS, RAN1 is required to enable temporary RS having up to 2 bursts. Once the temporary RS having up to 2 bursts is designed, RAN4 can specify SCell activation delay requirements for various conditions including how known SCell(s) can be assumed. |
| Futurewei | We are open to further discussion / conclusions from RAN1/4, however, quick actions may be needed to ensure we can complete the work on time. |
| Xiaomi | Option 3.1.1. As excerpted by FL, RAN1 already had discussions on the potential misalignment between network and UE for known/unknown case which is kindly highlighted in the agreement. We don’t think we need to come back to the same issue again. |
| Moderator | Thank you for your comments.***FL proposal 3 for a conclusion:****For the purpose of designing temporary RS for Scell activation, there is no RAN1 specification impact 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.** *Note: In RAN1 understanding, two different requirements of activation latency are expected to be developed in RAN4 for both cases of known SCell and unknown SCell, respectively.*
 |
| vivo | OK with the FL proposal 3 from moderator. |
| MTK | Fine with FL proposal 3 from moderator |
| NTT DOCOMO | Fine with FL proposal 3. |
| Intel | Fine with FL proposal 3. |

#### Issue-4: Earliest slot for triggered temporary RS

In RAN1#105-e meeting, the following agreement has been achieved, the reference slot for triggering offset of temporary RS is the last DL slot of the to-be-activated SCell overlapping with slot n+k as defined in 38.213 sub-clause 4.3.

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

Regarding the FFS bullet above, companies’ views seems converged, a potential proposal could be:

***FL Proposal****:* *The earliest slot no earlier than the reference slot for a UE to receive a triggered temporary RS.*

**Question 4: whether the above proposal is ok?**

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| ZTE | The FL proposal above is not clear. Maybe it should be updated as below.*Proposal:**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).* |
| Qualcomm | Agree with ZTE. |
| Futurewei | Agree with ZTE |
| Xiaomi | Agree with ZTE. |
| Spreadtrum | Agree with ZTE. |
| Moderator | Thank you for your follow-ups. The proposal is updated, your comments are welcome for the same table.***FL Proposal 4****:**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).* |
| vivo | Fine with the FL proposal 4. |
| MTK | Fine with the FL proposal 4. |
| NTT DOCOMO | Fine with the FL proposal 4. |
| Intel  | Fine with the FL proposal 4. |

#### Issue-5: QCL configuration of temporary RS

In the previous meeting, a working assumption has achieved as follows:

|  |
| --- |
| **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
 |

For the working assumption, 3 sub-issues are to discussed, and corresponding companies’ views are summarized.

**Issue-5.1: 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 5.1.1:** Due to uncertainty of known SCell and unknown SCell, it is difficult for gNB to judge and then to indicate whether a SSB before SCell activation is a safe QCL source for A-TRS. [7]

“*As of Rel-16, known and unknown SCell are RAN4 internal terminologies; and gNB and UE may not have the same understanding whether a to-be-activated SCell is known or unknown.*”

* **Opt 5.1.2:** Confirm [1][2][4][9][14]

**Question 5.1: whether the working assumption above can be confirmed?**

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| ZTE | Ok to confirm the working assumption. |
| Qualcomm | Yes. |
| Futurewei | A better and more complete solution exists. The WA is incomplete as it does not describe P/SP TRS but only SSB.A-TRS has not been a standalone RS --- it is associated with some P/SP-TRS. So it is expected that when A-TRS is configured and may be used as T-RS for activation, the associated P/SP-TRS is also configured. If the SSB can be used as a QCL source with Type C, then at least for some cases the P/SP-TRS can also be used as a QCL source with Type A, which is much better than Type C.Then the SSB and associated P/SP TRS of the to-be-activated SCell are the QCL source for the temporary AP TRS in case of known SCell, and the AP TRS serves as the QCL source for other RS following it, including P/SP TRS if sent after the AP TRS, and the AP/P/SP TRS serves as the QCL source for other RS after the P/SP TRS. It is also a bit unclear what the WA means by “… SSB … can be indicated as a QCL source …” Does it mean the MAC CE needs to include some TCI state pointing to the SSB? Can the WA be further clarified to describe how it may impact RAN1 design? |
| Xiaomi | Option 5.1.2, confirm the WA. |
| vivo | OK to confirm the working assumption. |
| MTK | OK to confirm the working assumption. The details mentioned by Futurewei can be figured out later. |
| NTT DOCOMO | Ok to confirm the WA. |
| Intel | Ok to confirm the working assumption. |

**Issue-5.2: if the working assumption is confirmed, which QCL types are expected?**

* **Opt 5.2.1:** 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block. [1][2][4][9][14]

**Question 5.2: which QCL types are expected if 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” is confirmed?**

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| ZTE | Opt 5.2.1, which is the same rule as in Rel-15. |
| Qualcomm | Yes (Opt.5.2.1) |
| Futurewei | Fine with Type C, but a more complete solution covering all involved QCL relations is needed. For example, if the P/SP TRS is also available, QCL Type A between P/SP TRS and the temporary RS would be preferred. |
| Xiaomi | Option 5.2.1. |
| Spreadtrum | **Opt 5.2.1** |
| vivo | Opt.5.2.1 |
| MTK | Opt.5.2.1 |
| NTT DOCOMO | Opt 5.2.1 |
| Intel | Opt.5.2.1 |

**Issue-5.3: For the case of unknown SCell, if SCell is contiguous to an active serving cell in the same band (Intra-band continuous CA), whether the mechanism of FR1 known cell can be reused?**

* **Opt 5.3.1:** Yes [4][9]
* **Opt 5.3.2:** No

**Question 5.3: For the case of unknown SCell, if SCell is contiguous to an active serving cell in the same band (Intra-band continuous CA), whether the mechanism of FR1 known cell can be reused?**

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| ZTE | Yes. The same mechanism can be reused. |
| Qualcomm | This belongs to RAN4 RRM discussion. |
| Futurewei | It is a bit unclear to us what is being discussed here. RAN4 already replied the following for FR1 unknown intra-band contiguous CA. Sorry if we missed anything. Please clarify.* *SCell is unknown and belongs to FR1*
	+ *When SCell is contiguous to an active serving cell in the same band (Intra-band continuous CA)*
		- *UE can perform AGC adjustment based on temporary RS;*
			* *One temporary RS burst with only “2-slot with four CSI-RSs resources (4 samples)” is required when the power difference in serving cell and to be activated Scell is smaller than or equal to 6dB.*
		- *No cell detection provided the conditions specified for intra-band contiguous CA case in TS38.133 section 8.3.2 are satisfied;*
		- *UE can perform time-frequency tracking based on temporary RS*
			* *One temporary RS burst with only “2-slot with four CSI-RSs resources (4 samples)” is required.*
 |
| Xiaomi | Clarification is needed. For known cell, the SSB on the to-be-activated cell can be configured as the QCL source of the temporary RS. What does the same mechanism mean? The purpose is to use the SSB on the adjacent active cell in the same band as the QCL source?  |
| vivo | The current question is not clear. Clarification is needed no what “mechanism of FR1 known cell” is considered for reuse. |
| MTK | Opt 5.3.1 (Yes) |
| Intel | Opt 5.3.1 (Yes) |

### The To-be-activated cell acquires essential information for activation enhancement from active cell

#### Issue-6: Tactivation reduction with BS assistance but no temporary RS nor SSB

It is proposed in [1][6] that activation time of the To-be-activated cell can be reduced by acquiring activation information (e.g. synchronization and AGC-related information, QCL information) from active cell(s) which are co-located with the To-be-activated cell. For example, the BS provides a UE the information of co-located reference active cells or source QCL cell to assist the activation of the To-be-activated cell, no SSB nor temporary RS is needed during the SCell activation procedure which can reduce the activation delay. The co-located SCells can be intra-band cells or adjacent inter-band cells.

**Question 6: Whether it is beneficial that neither SSB nor temporary is needed during SCell activation procedure, the AGC/time/frequency synchronization information derived from an activated cell?**

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| ZTE | It may need further check with RAN4. |
| Qualcomm | This belongs to RAN4 RRM discussion. |
| Futurewei | We think this is essentially the RAN4 reply on relying on another activated serving cell for AGC or tracking. RAN1 just needs to ‘translate’ the RAN4 inputs to QCL configuration / QCL assumption. So this should be supported. Alternatively, we are also open to other ways to capture RAN4 inputs into RAN1 spec. |
| Xiaomi | We agree with the spirit of the proposal. However, we also have the feeling that RAN4’s inputs are necessary. For example, whether the AGC/Tracking results based on the other Scell is accurate or sufficient for the target cell. |
| vivo | If this is only for the case of intra-band continuous CA, the answer depends on Question 5.3. For other cases, we should firstly check with RAN4. |
| MTK | Same view with vivo |
| Intel | Not sure if such solution in scope of the WI, since there is not temporary RS based activation acceleration. From the current LS from RAN4, temporary RS is needed in all the listed scenarios from RAN4.  |

## TCSI\_reporting reduction

### Issue-7: Enhancement for CSI reporting

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

* **Opt 7.1** New MAC-CE command that triggers the SCell activation and A-TRS transmission is used to additionally trigger A-CSI-RS transmission. [12]
* **Opt 7.2** Allow for CSI-RS reporting based on the temporary RS [9]

*“In order to enable early activation of the Scell it could be beneficial to allow for CSI-RS reporting based on the temp RS. This initial report would serve two purposes: confirmation of UE detection of temp RS signals and indication of start scheduling availability on the Scell, albeit conservatively.”*

* **Opt 7.3** short interval P/SP- CSI-RS report. [1]

“*The specific P/SP-CSI-RS/reporting for SCell activation can be received during the required period. This short interval P/SP-CSI-RS/reporting for fast SCell activation is beneficial with little specification impacts.*”

* **Opt 7.4** 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.*”

**Question 7: which options above of CSI reporting enhancement should be supported?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| ZTE | Seems the discussion above is related to the undergoing discussion in [106-e-NR-7.1CRs-06], which is trying to clarify whether DCI can be received on/for the to-be-activated SCell during SCell activation procedure. It is better to wait for the outcome in that email thread. |
| Qualcomm | We should first design temporary RS in this work item. |
| Futurewei | Opt. 7.1 and 7.2 can be considered. If the A-CSI-RS is viewed as part of the temporary RS, then these two options can be merged into one.Regarding the CR discussion, we think the 321 spec is quite clear that DCI cannot be received on/for the SCell before it is activated. |
| Xiaomi | We are open to CSI reporting issue but it should be deprioritized until temporary RS has a completed solution.  |
| Vivo | Opt 7.1 seems unnecessary as network can trigger AP-CSI-RS from another cell for CSI measurement on the being activated SCell.Opt 7.2 seems not useful as the temporary RS has only one port.Opt 7.3 is not favorable due to high RS overhead. |
| MTK | Same view with Xiaomi |
| Intel | Opt. 7.1 and 7.2 can be considered. It is better if A-CSI-RS can be triggered together with temporary RS, or A-CSI-RS is part of temporary RS. Opt. 7.2 can be considered too since anyway TRS is a kind of CSI-RS too.  |

## General Issues

**Question G1:** If two temporary RS bursts are transmitted, whether both bursts should employ the same temporary RS configuration? [9]

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| ZTE | Some clarification on the “RS configuration” is needed. For example, is triggering offset included in the “RS configuration”? The triggering offset may be different for the two bursts.  |
| Qualcomm | This is something that we assumed already. OK to confirm this. |
| Futurewei | Suggest to revisit this later after the temporary RS design is more clear. |
| Xiaomi | Our understanding is that the RS configuration here means the configuration within a RS burst. If this is the intention, we are fine to confirm. |
| vivo | It is better to clarify the details of “same temporary RS configuration”. Maybe we can start from, e.g., same frequency resource, RS structure, etc., should be employed for both bursts. |
| MTK | Same view with Qualcomm |
| Intel | Same view with Qualcomm |

**Question G2:** Whether the UE should provide the gNB information of which configured but inactive SCells are able to benefit from fast activation and/or the need for temporary RS? [9]

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| ZTE | Our understanding is that, all known SCells can benefit from fast activation. Could the proponents give some example scenarios for the above question? |
| Qualcomm | Not clear how this is different from usual measurement reports.  |
| Futurewei | Similar question as ZTE. Or maybe this is related to UE capability? |
| Xiaomi | Same question as ZTE/Futurewei.  |
| vivo | If the intention is for the UE to report whether a SCell is in known or unknown state, we think it is not necessary. |
| MTK | The intention seems for the UE to report whether a SCell is in known or unknown state. Since we are only designing temporary RS for known cell for now, we think this can bring benefits. |
| Intel | Same question as ZTE/Futurewei.  |

**Question G3**: Whether or not to additionally support AP CSI-RS, P/SP CSI-RS, SRS, and RS based on SSS/PSS as temporary RS, one or more of which may be used during SCell activation depends on network configuration / UE capability. [6]

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| ZTE | Currently, it is better to focus on the already agreed temporary RS and finalize all the remaining issues for it. If time permits, more temporary RS can be considered later on. |
| Qualcomm | We should first design temporary RS in this work item. It is not clear what to do for AP CSI-RS, P/SP CSI-RS, and SRS. It is not clear what the RS based on SSS/PSS is. Based on the agreements RAN1 made so far, we think in this work item RAN1 should focus on temporary RS designs for the time being. |
| Futurewei | These RSs are potential candidates for temporary RS, and should be further discussed in this WI. For example, if RAN1 wishes to speed CSI reporting, then CSI-RS should be included as part of temporary RS. AP SSB is also needed if the known/unknown cell issue can be resolved by sending AP SSB or if cell detection is needed (please refer to RAN4 replies: some cases do not require cell detection as stated by RAN4, but other cases may need). |
| vivo | Similar view as ZTE. |
| MTK | Same view with Futurewei. |
| Intel | Same view with Futurewei. |

## Other Issues

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

|  |  |
| --- | --- |
| *Company* | *View* |
| Futurewei | RAN1 agreement does not say that a temporary RS has to be on the BWP with firstActiveDownlinkBWP-Id; it only says that the measurement of the temporary RS, e.g., a TRS, is within the bandwidth of the BWP with firstActiveDownlinkBWP-Id. Thus, it seems possible that, say, the BWP with firstActiveDownlinkBWP-Id is BWP 1 but the TRS is configured on BWP 2, and the UE just performs measurement of the TRS on the overlapped bandwidth of BWP 1 and BWP 2. This can create some issues as shown in our tdoc. We proposed the following:*Further clarify / strengthen the previous agreement on BWP to include:**- All TRS(s) as temporary RS(s) can only be configured on the BWP with firstActiveDownlinkBWP-Id;**- The SCell always activates into the BWP with firstActiveDownlinkBWP-Id.* |
| vivo | We are fine to make the agreement clearer, and our understanding of the previous agreement is that the temporary RS is configured to the *firstActiveDownlinkBWP*. |
| MTK | Fine with Futurewei’s proposal. |
| Intel | Fine with Futurewei’s proposal. |

# Conclusions

For GTW session,

***FL Proposal 4****:*

*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).*

***FL proposal 3 for a conclusion:***

*For the purpose of designing temporary RS for Scell activation, there is no RAN1 specification impact 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.*

* *Note: In RAN1 understanding, two different requirements of activation latency are expected to be developed in RAN4 for both cases of known SCell and unknown SCell, respectively.*

Additional potential issue to be discussed this meeting as a follow-up to the following agreement,

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*

***Potential proposal:***

*If any BWP ID is configured within the configuration of temporary RS(s), the value of the BWP ID is expected to be equal to firstActiveDownlinkBWP-Id;*

# References

1. R1-2106473 Discussion on efficient activation/de-activation mechanism for SCells Huawei, HiSilicon
2. [R1-2106628](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2106628.zip) Discussion on efficient activation/de-activation mechanism for Scells vivo
3. [R1-2106722](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2106722.zip) Discussion on efficient activationde-activation mechanism for SCells in NR CA Spreadtrum Communications
4. [R1-2106750](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2106750.zip) Discussion on Support Efficient Activation De-activation Mechanism for SCells in NR CA ZTE
5. [R1-2106916](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2106916.zip) Remaining Issues on Scell Activation/Deactivation Samsung
6. [R1-2107086](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107086.zip) Support efficient activation/de-activation mechanism for Scells FUTUREWEI
7. [R1-2107278](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107278.zip) Discussion on efficient activation/de-activation for Scell OPPO
8. [R1-2107373](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107373.zip) Efficient activation/de-activation mechanism for SCells in NR CA Qualcomm Incorporated
9. [R1-2107527](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107527.zip) On low latency Scell activation Nokia, Nokia Shanghai Bell
10. [R1-2107615](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107615.zip) On efficient activation/de-activation for SCells Intel Corporation
11. [R1-2107642](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107642.zip) Fast SCell Activation InterDigital, Inc.
12. [R1-2107767](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107767.zip) On Efficient SCell Activation/Deactivation Apple
13. [R1-2107885](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107885.zip) Discussion on efficient activation deactivation mechanism for SCells NTT DOCOMO, INC.
14. [R1-2107904](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2107904.zip) Discussion on efficient activation and de-activation mechanism for SCell in NR CA Xiaomi
15. [R1-2108005](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2108005.zip) Reduced Latency SCell Activation Ericsson
16. [R1-2108047](file:///D%3A%5CDocuments%5C3GPP%20documents%5CRAN1%5CTSGR1_106-e%5CDocs%5CR1-2108047.zip) Efficient activation/deactivation of SCell ASUSTeK

# Appendix: Agreements

|  |
| --- |
| 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* |