**3GPP TSG RAN WG1 Meeting #105-e R1-2106147**

**e-Meeting,** **May 10th – 27th, 2021**

**Agenda Item: 8.13.3**

**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 May 24.

[105-e-NR-DSS-03] Email discussion/approval for efficient activation/de-activation mechanism – Frank (Huawei)

* 1st check point: May 24
* 2nd check point: May 27

According to the contribution papers under agenda item 8.13.3 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 8 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:** Triggering signaling for SCell activation/de-activation and temporary RS
* **Issue-2:** Time-domain property of TRS
* **Issue-3:** Number of temporary RS bursts
* **Issue-4:** Triggering offset of temporary RS
* **Issue-5:** QCL configuration of temporary RS
* **Issue-6:** Associated BWP for temporary RS
* **Issue-7:** Tactivation reduction with BS assistance but no temporary RS nor SSB
* **Issue-8:** Enhancement for CSI reporting

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

* **Question G1:** 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. [2]
* **Question G2:** If NACK is received for the PDSCH carrying the MAC-CE triggering a temporary RS, whether additional adjustment is necessary? [8]
* **Question G3:** Whether the existing Rel-16 A-CSI-RS/A-TRS triggering framework for temporary RS can be reused, or a new temporary RS trigger state list for SCell activation should be configured by higher layers? [8][21]

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 GTW session on May 24 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: May 24, and GTW session on May 24

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

* **Issue-1:** Triggering signaling for SCell activation/de-activation and temporary RS
* **Issue-2:** Time-domain property of TRS
* **Issue-3:** Number of temporary RS bursts
* **Issue-4:** Triggering offset of temporary RS
* **Issue-5:** QCL configuration of temporary RS
* For 2nd check point: May 27, 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.

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| *Company* | *View* |
| Qualcomm | OK with the suggestion, but please reflect our view captured in G3 into Issues 1 – 4. |
| Futurewei | We are generally fine with the suggestion.  We think an additional discussion on the scenarios (based on RAN4 inputs) may be useful.   * First, this will help us prioritize diverse scenarios and avoid different understandings on whether some (e.g., unknown cell) should be discussed or not. * Second, this will help align RAN1 understanding on RAN4 inputs and their impacts on RAN1. Some RAN4 inputs may not have direct spec impact on RAN1. For example, some RAN4 inputs are based on RAN4 terms such as “fine timing tracking” which will not be captured in RAN1 specs but may need to be reflected in RAN1 specs. Therefore, RAN1 needs to “translate” RAN4 inputs into something that is fully and directly “compatible” / understandable / actable by RAN1. * We suggest to further expand the table by the FL in 3.2.1.2 Issue-3 and reach a RAN1 agreement/conclusion on it. We suggest to discuss this for the 1st checkpoint. |
| ZTE | Ok with the prioritization. |
| vivo | Fine with the plan. |
| CATT | Fine with FL’s suggestion. |
| InterDigital | We are ok with the suggestion. |
| Nokia | OK with the plan |
| Samsung | OK with the suggestions |
| NTT DOCOMO | Fine with FL’s suggestion |
| Apple | Fine with the plan.  On the other hand, we would like to emphasis that Issue 8 is important to make this fast SCell activation feature useful; Otherwise, the period of P-CSI-RS would become bottleneck step and limit the practical benefit of the whole feature. |

# 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 SCell activation procedure

## THARQ reduction

### Issue-1: Triggering signaling for SCell activation/de-activation and temporary RS

In the last meeting, many candidate options for triggering signalling of temporary RS and SCell activation are discussed, and finally converged to the option that MAC CE(s) contained in a single PDSCH to trigger both SCell activation and corresponding temporary RS(s). One or two MAC CE in the option should be further studied, companies’ views are summarized as follows:

Opt 1.1: One new MAC CE for both SCell activation triggering and corresponding temporary RS triggering. [2][3][20]

Opt 1.2: One R15/16 SCell activation MAC CE for SCell activation triggering and one new MAC CE for corresponding temporary RS triggering. [5]

Opt 1.3: One Rel-15/16 SCell activation MAC-CE for SCell activation triggering and implicitly trigger the corresponding temporary RS. [2][6][9]

Opt 1.4: Left to RAN2 design. [16][21]

Potential Cons and Pros for above options are summarized below.

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|  | Potential Cons | Potential Pros |
| Option 1.1 | * Considering that the existing SCell activation MAC CE can still work well for Rel-17 efficient activation, it seems undesirable to introduce a new MAC CE with (partial) **duplication functionality**….The RRC-based SCell activation has been supported in Rel-16, in which case the temporary RS can also be supported. An integrated MAC CE would be problematic in this case. [5] * According to above analysis, gNB and UE does not have common understanding on whether a to-be-activated SCell is known or unknown. So gNB cannot always configure a precise A-TRS structure to match diverse to-be-activated SCell situation and **a conservative A-TRS structure is always applied**, then the flexibility of A-TRS structure is not necessary. [9] | * The new MAC-CE can be used to differentiate the Rel-17 fast SCell activation procedure from the legacy SCell activation procedure. With this, network and UE have the same understanding on the expected timeline. [4] * UE behaviour is simpler, and UE which receives the new MAC CE just follows Rel-17 UE behavior, i.e., UE can use temporary RS based on the indication in the MAC CE. [20] |
| Option 1.2 | * The new MAC CE for temporary RS triggering may not be useful for scenarios other than SCell activation, so it may not be used without accompanying the SCell activation MAC CE. That is, the new MAC CE for temporary RS triggering should only be expected in a PDSCH also carrying the SCell activation MAC CE.[2] * Usually it is an implementation issue to transmit two MAC-CE either jointly in one PDSCH or separately in two PDSCHs. gNB makes decision depending on available resource and system efficiency. Restriction on two MAC-CEs in one PDSCH may lead system efficiency loss. The decision on Option 3 should be made in RAN2, given the related spec impact happens in RAN2. [9] * UE which receives the legacy MAC CE needs to check whether the new MAC CE for temporary RS is included or not in the same PDSCH, and then UE follows Rel-17 UE behaviour or legacy UE behaviour accordingly. [20] | * Considering that the existing SCell activation MAC CE can still work well for Rel-17 efficient activation, it seems undesirable to introduce a new MAC CE with (partial) duplication functionality. [5] * The RRC-based SCell activation has been supported in Rel-16, in which case the temporary RS can also be supported. A separate MAC CE triggering temporary RS can be easily applied together with the RRC activation command. [5] * Reuse the Rel-15/16 SCell activation MAC-CE. [6] |
| Option 1.3 | * Only one TRS can be implicitly triggered. [3][6] * Flexibility is poor, e.g. gNB is hard to indicate temporary RS for some to-be-activated SCells but no temporary RS for some other SCells via one MAC-CE. [3] | * No additional signaling overhead to trigger the temporary RS. [3][5] * Reuse the Rel-15/16 SCell activation MAC-CE. [6] * No additional triggering mechanism for TRS. [6] * Smallest spec impact. [9] |

The detailed signaling design of MAC-CE is up to RAN2, but it should be RAN1’s task to decide what contents in the signal are necessary. **Therefore, a list of potential fields for the signaling is provided below,**

For each SCell among multiple to-be-activated SCells,

* Whether a temporary RS is triggered or not
* Resource ID of the triggered Temporary RS
* Triggering time offset of Temporary RS (To be discussed in issue 4.2. Preconfigured offsets may limit the available downlink slots for MAC-CE of SCell activation, especially for TDD carriers with UL/DL configuration, which seems a new but unnecessary restriction for L2 signaling)
* Number of temporary RS burst (To be discussed in issues 3.1)

**Question 1: Which option above should be supported? What contents should be included in the MAC-CE? Your views on benefit/gain, specification impact, implementation complexity are encouraged.**

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | Opt.1.1. |
| Futurewei | Opt. 1.3 can be the baseline with minimum standard impact.  We are open to other options as additional / configurable features if benefit can be shown. |
| ZTE | We support Opt 1.1.  A mechanism is needed to differentiate the legacy SCell activation timeline and the Rel-17 temporary RS based timeline. Opt 1.1 can be served for this purpose.  Opt 1.2 still needs to define a new MAC-CE, the spec impact is similar as Opt 1.1.  Opt 1.3 is too limited considering that we may need to trigger different TRS in different cases, e.g., TRS with different offset, beam, etc.  Regarding the contents in the MAC-CE, at least we can confirm that the TRS triggering state should be put in it. The other contents may have dependency on the detailed solutions for different options. |
| OPPO | Opt 1.3.  For the argument of using Opt 1.1 to differentiate Rel-17 timeline from legacy SCell activation timeline, even if the gNB delivers an Opt 1.1 new MAC-CE, the UE may still go with the legacy timeline (following up SSB-based SCell activation) if the UE determines the cell is unknown and there is no active serving cell in the same band of to-be-activated SCell. This is confirmed by RAN4 reply LS at least for FR2. So such differentiation is pointless.  For the listed potential MAC-CE fields:   * Whether a temporary RS is triggered or not:   + We do not see a strong need to make this choice dynamically adaptive. * Resource ID of the triggered Temporary RS:   + Same as above. The benefit of having dynamic adaptive resource for A-TRS is not justified. * Triggering time offset of Temporary RS (To be discussed in issue 4.2. Preconfigured offsets may limit the available downlink slots for MAC-CE of SCell activation, especially for TDD carriers with UL/DL configuration, which seems a new but unnecessary restriction for L2 signaling):   + There is certain existing logic to deal with this limitation, for example, with a pre-configured offset x, the A-TRS transmission starts in the earliest DL slot after n+x slot, where slot n is the slot for either sending triggering MAC-CE or sending HARQ-ACK for PDSCH carrying the MAC-CE.   + Because each A-TRS burst contains two consecutive DL slots, the interaction/restriction with TDD UL/DL configuration could anyway occur for any of the three signaling solutions. * Number of temporary RS burst (To be discussed in issues 3.1)   + According to RAN4 reply LS, very likely the needed number of temporary RS bursts is determined on UE side and unknown to gNB (gNB only needs to ensure to transmit what UE needs, as a maximum safe bet). So this parameter should be made either static or semi-static based on certain stable conditions, and not be included in MAC-CE.   So in summary, no candidate in the given list of potential MAC-CE fields deems to have essential need to be carried by MAC-CE. |
| vivo | We prefer Opt 1.2, but also OK to Opt 1.4. The contents of the MAC CE are dependent on the other issues (e.g., Issue 2, 3, 4, etc.).  Regarding the comment/cons to Opt 1.2 that “the new MAC CE for temporary RS triggering should only be expected in a PDSCH also carrying the SCell activation MAC CE”, as discussed in our paper, this is incorrect *because it can be used if RRC-based SCell activation is performed*, in which case no SCell activation MAC CE is sent together.  We have the following comments to other options, and hope that supporting companies can clarify:  For Opt 1.1, we are not very clear how it works in the case of RRC-based SCell activation.  For Opt 1.3, we are not sure whether it supports fallback to R15/16 SCell activation procedure, for example, in the case where no suitable resource can be used to send TRS. |
| CATT | Either Option 1-1 or Option 1-2 is OK to us given the most flexibility can be harvested. Which option is adopted in the end should depend on RAN2 decision. We should focus on what information related to TRS triggering is needed. |
| MTK | Opt.1.1. All the four potential fields for the signaling listed by FL can be provided in the new MAC-CE. Regarding RRC-based SCell activation, the dominant processing time would be the RRC message processing instead of Tactivation, and we tend to think focusing on MAC-CE based SCell activation is enough. |
| InterDigital | We prefer Opt. 1.1 |
| NEC | We prefer Opt 1.1. The contents of the MAC CE depend on the decisions taken for other relevant issues being discussed in this agenda item. |
| Intel | We prefer Opt 1.1, which is a cleaner solution. Opt 1.2 may require more discussions, e.g. whether the MAC CE triggering temporary RS and the MAC CE triggering SCell activation have to be in same PDSCH. |
| Nokia | RAN1 is not in charge of MAC, and the design and organization of the MAC-CE is a RAN2 issue, not up to RAN1 to decide. i.e. Opt 1.4.  RAN1 should focus on what information the MAC-CE needs to convey and what action that will trigger and convey this information to RAN2. |
| Ericsson | It may be better to first discuss what information about the temporary RS that is being triggered is configured by RRC and what (if any) information should be indicated via the new MAC/CE based mechanism (leave 1 vs 2 MAC CEs discussion to RAN2). Once this is clear, we can come back to discussing exact triggering mechanism.  From our perspective, Opt 1.3 is quite inflexible and is not preferred (temporary RS has to be always triggered even when not needed which causes extra overhead, QCL information cannot be changed once configured which not suitable for beamforming based transmissions).  Prefer to use A-CSI-RS trigger-state indication based approach.  Contents-wise, at least the following information should be sent. (Both can be indicated by trigger state ID.)  Whether/which A-TRS is triggered or not  QCL source for a- TRS |
| Samsung | Option 1.4 (same reasons as Nokia). |
| NTT DOCOMO | We prefer Opt 1.1 |
| Apple | Our preference is Opt.1.1 due to the simplicity and clean solution merit.  Regarding the concern on TRS for RRC-direct SCell activation, our understanding that it is independent SCell activation procedure and is NOT necessarily coupled with MAC-CE based signaling design. As one example, the required TRS can be directly configured as part of RRC-direct activation message without coupling with MAC-CE based approach.  On Opt.1.1 vs. Opt.1.2, the benefit of Opt.1.2 is unclear for us as it unnecessarily complicates and consumes two LCIDs at least. On the other hand, the selection between Opt.1.1 and Opt.1.2 can also be left to RAN2 (i.e., Opt.1.4) as indicated by Nokia, if RAN1 cannot down select. |
| Moderator | Based on latest companies’ feedbacks, more concerns are summarized below,  Concern for Opt 1.1:   * How it works in the case of RRC-based SCell activation   Concern for Opt 1.2   * Benefit of Opt.1.2 is unclear for us as it unnecessarily complicates and consumes two LCIDs at least   Concern for Opt 1.3   * Whether it supports fallback to R15/16 SCell activation procedure * Temporary RS has to be always triggered even when not needed which causes extra overhead, QCL information cannot be changed once configured which not suitable for beamforming based transmissions   For the contents in MAC-CE(s), the majority views seem that at least triggering state of temporary RS for each to-be-activated SCell is needed.  @vivo Regarding RRC based SCell activation (i.e. the concern for Opt 1.1), it is better to trigger temporary RS by RRC as well because the UE can start SCell activation once the RRC is received. If additional MAC-CE signaling has to be required, then the RRC based SCell activation has no benefit over MAC-CE based SCell activation.  @OPPO It has been agreed that “• *Note: the final mechanism of trigger signaling targets at applicability to one or more SCell activation.*” In case of multi-Scell activation via a MAC-CE/PDSCH, it is more appropriate for a gNB to indicate no temporary RS for some SCells to a UE when there is no appropriate temporary RS resources for those SCells at that activation event. It is hard for the gNB to determine the availability of RS resources for multiple SCells in advance. In a certain slot, there may be available resource for some Scell, but no resource for the other Scells. So the triggering state of temporary RS is not appropriate to be preconfigured by RRC.  @Ericsson, regarding reusing CSI-AperiodicTriggerState to indicate temporary RS, the CSI-AperiodicTriggerState is based on configuration of CSI report, but temporary RS does not require any dedicated CSI report, so the CSI-AperiodicTriggerState contains too many redundant signals. More importantly, it is not flexible enough to allow a gNB to trigger temporary RS for some of to-be-activated Scells while not trigger any for other to-be-activated SCells. If CSI-AperiodicTriggerState is reused, a gNB has to pre-configure a long list of CSI-AperiodicTriggerState to cover all possible combinations of SCells and trigger state of temporary RS. On the contrary, it is more flexible and lower overhead if the triggering state of temporary RS is directly indicated as a field of MAC-CE. |
| vivo2 | Thanks Moderator providing answer to our question. I understand RRC based temporary RS triggering is one solution (maybe better solution) for RRC based SCell activation. But in this case, should RAN1 manage to design the RRC based triggering, or should it be handled by RAN2? |

With above summary, a potential proposal is,

***Proposal 1****: To trigger temporary RS for efficient activation of SCells,**the contents of the triggering MAC-CE(s) in a single PDSCH include at least:*

* *Triggering state of temporary RS for each to-be-activated SCell.*
* *FFS: Resource ID of the triggered Temporary RS*
* *FFS: Triggering time offset of Temporary RS*
* *FFS: QCL source for a- TRS*
* *Note: Up to RAN2 decision on detailed signaling structure of the triggering MAC-CE(s) including the down-selection between the following options*
  + *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*

Comments are welcome.

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| *Company* | *View* |
| Futurewei | We’d like to address the concerns for Opt 1.3:   * First, we suggested Opt. 1.3 as a baseline and it can be combined with other options. So if more flexibility is needed, the network can still signal other information about the temporary RS to the UE. * Opt. 1.3 can support fallback activation procedure, and does not have to trigger temporary RS every time, IF the network does not configure a default temporary RS for activation. That is, with a default temporary RS configured for activation, the gNB/UE follow the new mechanism but otherwise they follow the legacy mechanism. * This approach has probably the minimum standard impact and implementation impact to support temporary RS triggering. More flexible/complicated mechanisms can be optional/configurable based on UE/gNB implementation.   With the above replies, we hope Opt 1.3 can still be considered. We rephrased the proposal to incorporate this.  Some other comments on the proposal:   * The FFSs list some temporary RS parameters. We probably cannot make a complete/accurate list of the parameters. We suggest to change to “FFS: Detailed parameters for the triggered temporary RS”. Also these parameters may be in RRC and/or MAC, so we cannot say they have to be “included” in the MAC CE(s) contents. RAN1 should FFS which parameter(s) are included in the MAC-CE(s) and which are configured in RRC (as illustrated by FL’s Proposal 3). * For the note, RAN1 may not want to limit RAN2’s design options. We suggest to change the wording as “example options” for RAN2.   Our suggested revised proposal:  ***Proposal 1****: To trigger temporary RS for efficient activation of SCells,**the contents of the triggering MAC-CE(s) in a single PDSCH provide information on at least:*   * *Temporary RS for a to-be-activated SCell.* * *FFS: Detailed parameters for the triggered Temporary RS, e.g., triggering state, resource ID, triggering time offset* * *FFS: Which parameter(s) are included in the MAC-CE(s) and which are configured in RRC* * *Note: Up to RAN2 decision on detailed signaling structure of the triggering MAC-CE(s) including the following example options*   + *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* |
| CATT | We are supportive to the proposal.  For the third FFS on QCL source, we are wondering why it is needed. QCL information is configured via RRC and nothing about MAC CE. |
| vivo | We are fine with the proposal.  @CATT Our understanding is that the QCL information is needed to activate a TCI state for the UE to monitor the TRS, similar to the existing TCI activation procedure.  @Futurewei Regarding the fallback design for Opt 1.3, if I understand correctly, your solution is to enable fallback operation by explicit RRC reconfiguration, i.e., if the network does not want to trigger temporary RS (e.g., due to potential resource collision), the network should first reconfigure the temporary RS, and then start the SCell activation. I don’t think such a lengthy procedure is really useful for fallback. |
| ZTE | We still have concern on the two MAC-CE solution. This will require higher RAN2 spec impacts, e.g., the association/relationship between the two MAC-CEs. Regarding for the RRC-based solution, we think it is a separate issue and can be discussed separately. In fact, RAN2 discussed similar issue for indication of the QCL info, companies discussed the RRC-based solution to indicate the QCL info. We can also use the RRC-based solution to indicate the TRS if necessary.  Overall, Opt 1.1 is the preferred solution from our perspective. Regarding the proposal above, we didn’t see the necessities to list all the FFS here. Companies will keep debating the FFS here, which is not efficient. We suggest to delete all the FFS for now. |
| Spreadtrum | We have 2 questions for the first bullet, “Triggering state of temporary RS for each to-be-activated SCell”.  1. Does it mean when there are only T-RS triggering or non-triggering according to to-be-activated SCell? For example, when there are 2 to-be-activated SCell, the MAC-CE will only contains 2 T-RS triggering states? If this is right understanding, then we don’t understand how to keep the fixed size of MAC-CE.  2. From the discussion, we guess there would be several T-RS configurations for one SCell, each can have different parameters, such as frequency and time resource, TRS pattern, etc. So here the triggering state means more than 1 bit for a SCell, right? Such as there are 3 T-RS configurations, one triggering state for one SCell would be use 2 bits for non-triggering and triggering one T-RS.  Basically, we agree that signaling should be up to RAN2. However, RAN1 should provide detailed solution to RAN2.  For the FFS points, we support to leave them here. They are good for further discussion. |
| Ericsson2 | Replying to FL comment to Ericsson, in our view, there are enough states in the trigger state list to be able to accommodate the A-TRS. We are not sure what is meant by too many redundant signals, but we would think it is up to gNB implementation how to manage the trigger state list.  Designing an altogether new way of communicating TRS information seems unnecessary. If existing trigger state list is considered insufficient (e.g. the additional A-TRS triggering states for SCell activation related A-TRS triggering increase the CSI request field DCI size), then a new list can be defined.  The FL proposal seems to include all the fields into the MAC CE, and this would increase the MAC CE payload size compared to the trigger state list based mechanism.  Regarding FL proposal 1 :  The first main bullet – change “include” to provide at least following information (explicitly or implicitly). As mentioned by several companies, MAC CE design/contents are up RAN2 – RAN1 should work on what information the MAC CE should communicate, and RAN2 can decide whether to include the information directly/indirectly into the MAC CE.  First sub-bullet is unclear – ‘triggering state’ is ambiguous i.e., is the intention that ‘triggering state’ a) just tells yes/no for presence or b) is used for indicating yes/no presence, structure/resources of the RS, QCL info like in Rel16.  Our preference is to use the trigger state list like approach from Rel16 (so b) above) and this should not be precluded. Propose to update as follows  ***Proposal 1****: To trigger temporary RS for efficient activation of SCells,**the contents of the triggering MAC-CE(s) in a single PDSCH provide at least following information (explicitly or implicitly):*   * *Whether or not temporary RS is triggered for each to-be-activated SCell.* * *FFS Information indicating the following:*    + *Resources used for triggered Temporary RS*   + *Triggering time offset of triggered Temporary RS*   + *QCL source for triggered Temporary RS* * *FFS between following*   + *information is indicated explicitly in MAC CE*   + *information is included in RRC configured trigger state list and corresponding trigger state ID is included in MAC CE* * *Note: Up to RAN2 decision on detailed signaling structure of the triggering MAC-CE(s) including the down-selection between the following options*   + *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* |
| OPPO | The proposal does not make it clear what “*Triggering state of temporary RS*” means.  -- If “*Triggering state of temporary RS*” means binary “Yes vs. No” to indicate whether A-TRS is triggered or not, we do not think such indication of “state” is necessary, because if the intention is to have a new MAC-CE (in either Opt 1.1 or Opt 1.2), whether to trigger A-TRS can be already identified by LCID/eLCID in MAC-CE subheader, e.g., the legacy MAC-CE with LCID=57 (legacy value in 38.321) can trigger SCell activation without A-TRS, and a new MAC-CE with new LCID value can work with A-TRS.  -- If “*Triggering state of temporary RS*” means something other than binary indication of whether A-TRS is triggered or not, the first bullet is better to be FFS if giving no further details on “triggering state”.  We share the similar view with Futurewei and ZTE on the FFS list. If people do not want to waste time on deciding which should be in the FFS list and which should not be, it is better to either remove the whole FFS list or just keep a single bullet as Futurewei suggested.  We agree that, if Opt 1.3 is removed from the table in RAN1, the remaining signaling structure discussion should be taken in RAN2.  On the other hand, Opt 1.3 is still our preference at this time, due to its least spec impacts in both RAN1 and RAN2.   * We are not convinced by FL’s rational of the need for gNB to dynamically (on MAC-CE level) decide to switch to SCell activation w/o A-TRS because it cannot dynamically offer the resources to transmit A-TRS. Denote T1 as SCell activation delay w/o A-TRS and T2 as the SCell activation delay w/ A-TRS, then the FL’s comments seem to say:   “If the gNB cannot transmit A-TRS in the next N slots, it is a better choice to go with legacy SCell activation w/o A-TRS.”  Then the question is whether the number of N could justify a throw-away of the time saving (T1-T2) of using SCell activation with A-TRS.   * As for the QCL relationship to be included in MAC-CE, it is still a question in a separate discussion whether the gNB can ensure the QCL source relation without knowing known vs. unknown SCell status. |
| Qualcomm | Futurewei’s proposal updated by Ericsson is a good starting point. The two FFSs are the key points for RAN1 to consolidate.  On the Note, we prefer just to say FFS unless we send an LS to RAN2 in this meeting.  ***Proposal 1****: To trigger temporary RS for efficient activation of SCells,**the contents of the triggering MAC-CE(s) in a single PDSCH provide at least following information (explicitly or implicitly):*   * *Whether or not temporary RS is triggered for each to-be-activated SCell.* * *FFS Information indicating the following:*    + *Resources used for triggered Temporary RS*   + *Triggering time offset of triggered Temporary RS*   + *QCL source for triggered Temporary RS* * *FFS between following*   + *information is indicated explicitly in MAC CE*   + *information is included in RRC configured trigger state list and corresponding trigger state ID is included in MAC CE* * *FFS~~Note~~: whether it is Up to RAN2 decision on detailed signaling structure of the triggering MAC-CE(s) including the down-selection between the following options*   + *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* |
| Intel | We think the meaning of *Triggering state of temporary RS* needs to be clarified. If a triggering state is configured with a set of temporary RS including time/frequency resource, time offset and QCL, it seems the three FFS (indication of the parameters by MAC CE) are not needed. |
| NTT DOCOMO | It should be clarified what is “Triggering state of temporary RS for each to-be-activated SCell”. We are fine with the proposal updated by Qualcomm. |
| Nokia | We supporte the latest proposal from **Ericsson.** The Qualcomm update of FFS over note doesn’t seem to make much sense as how would RAN1 study whether the MAC-CE signalling structure is up to RAN2 decision or not? MAC is as per RAN2 ToR up to RAN2 and RAN1 is not in a position to debate that. |
| MTK | We also think “Triggering state of temporary RS” is not clear enough. Updated proposal from Ericsson2 or Qualcomm are both fine to us. |
| Futurewei2 | @vivo: Thank you for your comment on the fallback scheme. As described above, we are also supportive of Opt. 1.1 or 1.2 on top of Opt. 1.3. This provides full flexibility for the network to decide how to activated the SCell / how to trigger the temporary RS. Opt. 1.3 can also be used alone for its super simplicity, thus it also has merit to be considered here.  @Apple: Thank you for your comment on the SCell direct activation by RRC. However, the RRC activation is a slow process. We are not sure how much benefit temporary RS can lead to in this case.  Anyway we are open to hear more technical comments on 1.3.  Based on above discussions, we suggest the following revised proposal:  ***Proposal 1****: To trigger temporary RS for efficient activation of SCells,**the contents of the triggering MAC-CE(s) in a single PDSCH provide information on at least:*   * *Temporary RS for a to-be-activated SCell.* * *FFS: Detailed parameters for the triggered Temporary RS, e.g., triggering state, resource ID, triggering time offset* * *FFS: Which parameter(s) are included in the MAC-CE(s) and which are configured in RRC* * *Note: Up to RAN2 decision on detailed signaling structure of the triggering MAC-CE(s) including the following example options*   + *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* |
| Apple | We support FL proposal in general.  Regarding the comment on the 1st sub-bullet, our understanding is that it covers all possibilities, including single or multiple TRS configurations and corresponding triggering state list. That’s the reason why the ‘triggering state of TRS’ is needed in MAC CE to provide flexibility for gNB to select temporary RS for each SCell being activated such that the overhead can be minimized.  @Futurewei, we are not saying temporary RS has to be supported for RRC-direct SCell activation procedure. Instead, if it is justified for RRC-direct SCell activation due to whatever reason, the temporary RS can still be separately configured, instead be coupled with temporary RS used in MAC-CE based procedure. In other words, the temporary RS for RRC-direct SCell procedure and MAC-CE based faster SCell activation procedure can be independently configured. It should not be a concern to introduce a single MAC CE for both SCell activation and temporary RS triggering i.e., *Opt. 1.1.* |
| Moderator | @Spreadtrum I feel the solution to your question is about detailed signaling design and is up to RAN2. But if it helps, an example with a fixed size of MAC-CE could be provided. Similar to the field of SCell activation/deactivation in Rel-15/16 MAC-CE, there is 16 bits in the new MAC-CE, each bit corresponds to one configured serving cell, and its value “1” represents that temporary RS is triggered. In this example, the size of MAC-CE is fixed. To resolve your concern, the proposal could be refined by replacing “for each to-be-activated SCell” with “for each configured SCell”, but it is kind of related to detailed signaling structure. I hope it can be left for RAN2 to decide, as the note in the proposal says.  @Ericsson, In A-TRS triggering, one DCI indicates one state of CSI-AperiodicTriggerStates (maximum 128 states), which corresponds to maximum 16 CSI-AssociatedReportConfigInfo. Since one CSI-AssociatedReportConfigInfo only corresponds to one serving cell, its flexibility is limited. For example, for a CA with 32 serving cells, the combination of On/Off state of Temporary RSs for all 31 SCells has a set size of 2^31, which is more than 128\*16. Besides, the IE CSI-AssociatedReportConfigInfo contains many items not useful for temporary RS.  @OPPO, Your focus seems to be only one SCell that is to be activated. But for the case of multiple SCells, in our understanding, LCID cannot tell which SCells out of 32 configured SCells are triggered with temporary RS, which are not. Regarding the implicit indication of #N slot offset for temporary RS, the #N slot offset is preconfigured. So could you please elaborate a bit your solution in case that gNB finds no resource at that slot offset for temporary RS for one SCell? In our understanding, either dynamically indication of slot offset, or dynamically indication of no temporary RS for the event of SCell activation, but both cannot be preconfigured and implicitly indicated, especially for the case of multiple SCells.  To incorporate Futurewei, Ericsson and QC’s suggestions, the proposal is revised as,  ***Proposal 1-v2****: To trigger temporary RS for efficient activation of SCells,**the contents of the triggering MAC-CE(s) in a single PDSCH provide at least following information (explicitly or implicitly):*   * *Whether or not temporary RS is triggered for each to-be-activated SCell.* * *FFS detailed Information of temporary RS, e.g. ~~indicating the following~~:*    + *Resources used for triggered Temporary RS*   + *Triggering time offset of triggered Temporary RS*   + *QCL source for triggered Temporary RS* * *FFS between following*   + *information is indicated explicitly in MAC CE*   + *information is included in RRC configured trigger state list and corresponding trigger state ID is included in MAC CE* * *Note: Up to RAN2 decision on detailed signaling structure of the triggering MAC-CE(s) including the down-selection between the following example options*   + *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* |

#### FL proposal

Based on GTW discussion,

***Proposal 1-v3****:*

*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 for each to-be-activated SCell.*
* *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 signaling 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*
* *Note: the number of temporary RS bursts has been agreed to be included.*

Any comments are welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Nokia | Support the moderator’s proposal 1-v3.  If the sub-bullets of the “FFS detailed information of temporary RS” cause controversy, those can of course be removed. That said, they are a list of examples under and FFS bullet, so keeping them would at least convey some information on what has been considered. |
| Qualcomm | In general OK with the proposal 1-v3. A couple of suggestions below.   * Considering the online comments, it would be better to delete “for each to-be-activated SCell” from the 1st bullet. Regardless of with or without, details need to be discussed in future. * The last “Note:” is not necessary as it has been agreed anyway.   ***Proposal 1-v3****:*  *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 ~~for each to-be-activated SCell~~.* * *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 signaling 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* * *~~Note: the number of temporary RS bursts has been agreed to be included.~~* |
| CATT | We are fine with Qualcomm’s revision.  For ‘*QCL source for triggered Temporary RS*’ under the first FFS point, we are still not sure on the intention. We understand the purpose is to follow the current two-step indication, i.e. RRC configuring a list and MAC CE indicates one particular combination in the list.  However, considering we have mentioned the information related to RS resource, typically the QCL source information is included in the RS configuration. In the other word, if MAC CE indicate a RS resource ID, it will linked to a bunch of configuration which should include QCL information, i.e. TCI state.  Or it intentionally dynamically changes the TCI state for a TRS resource, i.e. a T-RS can be configured with multiple TCI states? |
|  |  |

## Tactivation reduction

### Temporary-RS based

#### Issue-2: Time-domain property of TRS

In the previous meeting, TRS is selected as the temporary RS. Some companies further analyze the triggering TRS type by MAC CE. Companies’ views are summarized as follows:

* **Opt 2.1** Aperiodic TRS [1][2][4][7][16][18][19]

***FL Proposal****: For efficient activation of SCells, the TRS triggered for temporary RS is aperiodic.*

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

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | Before agreeing this, we need to agree/confirm first whether the temporary RS is the legacy TRS. |
| Futurewei | Support the proposal.  For Qualcomm’s comment, we think the proposal wording can incorporate either case (regardless of legacy TRS or new TRS).  But we are ok with rephrasing the proposal to address Qualcomm’s comment, such as  *For efficient activation of Scells, the ~~TRS~~ triggered ~~for~~ temporary RS is aperiodic.* |
| ZTE | Ok with this proposal. |
| OPPO | Ok with the modified version from Futurewei. |
| Vivo | OK with this proposal. |
| CATT | Support. |
| MTK | Support |
| InterDigital | We support the proposal. |
| NEC | Support the proposal |
| Intel | Support |
| Nokia | Support the proposal, the “triggered temporary RS is aperiodic” as Futurewei wrote. |
| Ericsson | Same comment as Qualcomm |
| Samsung | Support the proposal. |
| NTT DOCOMO | Ok with this proposal. |
| Apple | Support the proposal.  Regarding Qualcomm’s comment, we agree it is important to discuss and conclude. On the other hand, whether it is legacy TRS or not seems a separate discussion point. |
| Moderator | The majority view seems ok with the Futurewei’s revision.  @Qualcomm, Ericsson, Please elaborate your concerns a bit. If it is not aperiodic, do you suggest the triggered temporary RS should be effective even after the Scell is activated or something?  *Proposal: For efficient activation of Scells, the ~~TRS~~ triggered ~~for~~ temporary RS is aperiodic.* |

With above summary, a potential proposal is,

***Proposal 2****: For efficient activation of Scells, the ~~TRS~~ triggered ~~for~~ temporary RS is aperiodic.*

Comments are welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Spreadtrum | Support |
| Ericsson2 | We are OK with revised formulation.  In original formulation, whether multiple bursts were included or not was unclear. |
| OPPO | Agree |
| Qualcomm | OK for us. |
| Intel | Support |
| NTT DOCOMO | Support |
| Nokia | Support |
| vivo | OK |
| ZTE | Ok for us. |
| MTK | Support |
| Futurewei2 | Support |
| Apple | Support. |
| CATT | Support. |

#### Issue-3: Number of temporary RS bursts

In RAN4 reply LS R4-2105799, there are some conclusions on the temporary RS for SCell activation.

|  |  |  |  |
| --- | --- | --- | --- |
| FR1 | known | MC <= 160ms | 1 burst for AGC and T/F tracking |
| MC > 160ms | 1 burst for AGC, and separate 1 burst for T/F tracking  Gaps between RS symbols for AGC and T/F tracking:   * Option 1: 2 slots * Option 2: 2 ms |
| unknown | Intra-band continuous CA | 1 burst (4 samples) for AGC and 1 burst (4 samples) for T/F tracking |
| Other cases | TBD |
| FR2 | known | at least one active serving cell on that FR2 band | 1 burst (4 samples) can be used for T/F tracking |
| unknown |
| known | no active serving cell on that FR2 band | 1 burst (4 samples) can be used for T tracking  FFS: number of symbols |
| unknown | no active serving cell on that FR2 band | Temporary RS cannot be used for AGC |

When the temporary RS can be used for efficient SCell activation, one or two temporary RS bursts are required and a gap between the RS symbol(s) for AGC and the RS symbols for time/frequency acquisition should be considered. RAN1 should take the reply into account, two sub issues should be discussed and companies’ views are summarized below.

**Issue-3.1: Indication of number of temporary RS bursts**

Opt 3.1.1: Configured within temporary RS configuration by RRC. [1][3][21]

Opt 3.1.2: Indicated in the MAC CE. [1][17][19]

Opt 3.1.3: Always 2 temporary RS bursts. [5][9]

Opt 3.1.4: No need to explicitly indicate according to RAN4 requirements. [4] (Quoted as below)

*“RAN4 will define corresponding requirements for Rel-17 fast SCell activation, network can repeat the TRS for a number of times as long as the requirements defined by RAN4 can be met. On the other side, UE can receive and measure the TRS for a particular number of times, it doesn’t need to measure all TRS as long as the requirements can be met by the UE.”*

**Question 3.1: Which option above should be selected with the RAN4 reply taken into account? Your views on benefit/gain, specification impact, implementation complexity are encouraged.**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | For each triggering state, a temporary RS that comprises one or two bursts with a gap is configured by RRC. Then, the triggering state is indicated by MAC-CE triggering signalling for the temporary RS to be transmitted. This is a combination of Opt.3.1.1 and Opt.3.1.2 and similar to legacy A-CSI-RS/A-TRS triggering via UL DCI. |
| Futurewei | We can be generally open to the options, but we want to emphasize that further clarification of RAN4 inputs is needed. For example, in the 3rd row in the FL’s table, it says “1 burst (4 samples) for AGC and 1 burst (4 samples) for T/F tracking”, but since the cell is unknown, based on RAN4 LS reply, cell detection may be needed if the conditions specified for intra-band contiguous CA case in TS38.133 section 8.3.2 are not satisfied. This may mean for some cases, 2 bursts for row 3 are insufficient, and a SSB may be needed.  RAN1 needs to have a more complete picture on the numbers of TRS bursts / [SSB bursts] to make a good decision on this issue. Otherwise, RAN1 may be forced to revisit this issue even after reaching an agreement. |
| ZTE | Our current understanding is Opt 3.1.4. We would like to understand the necessity of indicating the number of bursts and what would be the consequence if gNB doesn’t indicate the number of bursts.  If we indicate the number of bursts, it seems to imply that UE has to receive all the bursts. |
| OPPO | Our preference is given below, and different from Opt 3.1.3:   * For SCell activation in FR1: Always 2 temporary RS bursts. * For SCell activation in FR2: Always 1 temporary RS bursts.   We wonder how Opt 3.1.1 and Opt 3.1.2 can work, given the number of temporary RS bursts that UE needs/requires is based on certain condition (known cell vs. unknown cell) that the gNB may not accurately/timely know.  Opt 3.1.4 actually says the gNB can transmit certain temporary RS signal in certain slots (which are beyond what UE needs) without telling any UE about such excessive transmission. We doubt whether this can be a good practice in Uu interface specification. |
| vivo | We think Opt 3.1.3 is the most simple and robust solution that can work in every case even if the network does not clearly know the MC and known/unknown status of the SCell of the UE.  Regarding Opt 3.1.1/3.1.2, we agree that they can reduce RS overhead in some case, but the key concern is that the network and UE may not have aligned understanding on the SCell (i.e., known or unknown, MC length, etc.). |
| CATT | As gNB cannot recognize whether it is known/unkown to the UE, it cannot have a clear idea how many TRS bursts should be indicated. From this perspective, option 3.1.3 is reasonable.  Furthermore, as summarized by the FL, only T/F tracking is mentioned in some scenarios while whether additional TRS burst for AGC settling is needed or not is unclear. It is critical for determining the number of TRS burst and should be clarified firstly. |
| MTK | Opt 3.1.2 or Opt 3.1.1 to leave the flexibility in case more bursts are needed for unknown cell case, which RAN4 has not replied. We also want to echo Futurewei’s comment on avoiding revisiting this issue. |
| NEC | We prefer option 3.1.2. As pointed out by MTK, it gives the flexibility to indicate greater than two bursts in case more bursts are required for the cases on which RAN4 has not replied yet. |
| Intel | We share Qualcomm’s view, i.e. a combination of Option 3.1.1 and 3.1.2 can be used. To be specific, there is not an explicit field indicating the number of bursts in Option 3.1.2. If gNB is too aggressive and does a wrong judgement on known/unknown and send only one Temporary RS burst to UE, UE may fail the fast SCell activation. However, such failure is under gNB control and happens with low rate. |
| Nokia | We may need further RAN4 input before the final decision can be taken, but for now it looks like the RRC configuration (the measurement cycle) will determine if 1 or 2 bursts should be triggered. This is perhaps what is meant with 3.1.4, but we understood this to be 3.1.1 as it is related to RRC config.  The core question to ask is that do we need to explicitly provide the UE with the # of bursts and if so, is it sufficient to provide this in the RRC, or is MAC-CE something that is needed. |
| Ericsson | Option 3.1.1 and 3.1.2. We do not prefer Opt 3.1.3 as it unnecessarily increases overhead. |
| Samsung | Option 3.1.4.  Also OK with not optimizing SCell activation/deactivation for use-cases requiring 2 temporary RS bursts as they do not represent relevant scenarios for enhancements of SCell activation/deactivation. |
| NTT DOCOMO | Option 3.1.1 + Option 3.1.2. We share Qualcomm’s view. |
| Apple | We think more discussions are needed before down selection of options.  The main motivation of Opt.3.1.3 seems the possible misalignment on known vs. unknow state of SCell between gNB and UE. RAN1 needs to discuss and conclude whether it is common understanding or not. If it is confirmed, one interpretation e.g., Intel, is that the UE is allowed to fallback to legacy SCell activation procedure based on SSB with larger latency. In other words, the tighter timing requirement would not be required for UE in this mis-alignment case. Our view is that RAN1 should make conclusion/agreement on this and let RAN4 know; Otherwise, UE maybe mandated to meet the tighter timing requirement for fast SCell activation even the misalignment situation happens between gNB and UE.  If all the pending points above are clear up and UE is allowed to fallback to SSB-based legacy procedure for misalignment case, we share views from Qualcomm and Intel that ‘Opt.3.1.1 + Opt.3.1.2’ provides the best flexibility and very similar as the legacy DCI-based approach. |
| Moderator | Concerns:   * Potential misalignment between gNB and UE on the known/unknown state of a SCell at the UE. The gNB may have to take a conservative strategy on the number of bursts of temporary RS. (OPPO, vivo, CATT * Higher overhead for always sending max number of bursts (Ericsson) * 2 bursts may not be sufficient. For some unknown cases, more bursts of temporary RS and even SSB burst may be needed which is still under discussion in RAN4. (Futurewei) * Alternatively, Opt 3.1.1 and Opt 3.1.2 can be combined together so that the number of bursts is RRC configurable in a list.   We can go with the combination of Opt 3.1.1 and Opt 3.1.2, but some detailed signaling can be FFS at this stage. |

With above summary, a potential proposal is,

***Proposal 3****: For efficient activation of a Scell, the number of temporary RS bursts is implicitly indicated by a field in new MAC-CE*

* *The number of temporary RS bursts is RRC configurable.*
* *The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of the number of temporary RS bursts*
* *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS*

Comments are welcome.

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| --- | --- |
| *Company* | *View* |
| Spreadtrum | For the first bullet and second bullet, what is the relationship between RRC configuration and a field in MAC-CE? Does it mean RRC first configure several sets, each set contains T-RS bursts number, and then MAC-CE indicate one of the set? If it is yes, then whether this bursts number can be applied to any triggered T-RS, regardless of which T-RS is triggered by triggering state.  For FFS point, from our understanding, T-RS bursts number depends on frequency range, measurement period, whether there are other activated SCell, known or unknown. So we don’t see necessary association with triggering state ID of T-RS.  Another similar clarification is should this field is per “to-be-activated SCell” or for all SCells. |
| Ericsson2 | We suggest removing the second bullet as details of the association needs further discussion. For example, a triggering state list mechanism is still possible, and the field of MAC CE can indicate multiple TRSs, each with a different number of bursts.  ***Proposal 3****: For efficient activation of a Scell, the number of temporary RS bursts is implicitly indicated by a field in new MAC-CE*   * *The number of temporary RS bursts is RRC configurable.* * *~~The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of the number of temporary RS bursts~~* * *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS* |
| OPPO | Do not support.  Suppose the RRC configures both one-burst and two-bursts. How does gNB, without knowing known vs. unknown status for the UE, safely decide at a time that only one burst is sufficient so it indicate so in MAC-CE? This is well-known issue, but the proposal 3 does not make it clear how to work around this issue. |
| Qualcomm | In general fine (Ericsson’s change is fine also), but the proposal looks “explicit indication”, not “implicit indication”. Just to avoid the confusion, suggest to delete “implicit”. Some other wording changes are suggested below.  ***Proposal 3****: For efficient activation of a Scell, the number of temporary RS bursts is ~~implicitly~~ indicated by a field in new MAC-CE*   * *The number of temporary RS bursts is RRC configurable.* * *~~The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of the number of temporary RS bursts~~* * *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS* |
| Intel | It is confusing to use ‘implicitly’. Does it mean that the number of temporary RS bursts are jointly indicated with other configurations of temporary RS by a field in new MAC CE? |
| NTT DOCOMO | We are generally fine with the proposal. The wording of “implicit” might be misunderstood and can be deleted. |
| Nokia | In general OK, and would support the Qualcomm revision. OK with keeping the “implicitly” as we would not expect the MAC CE to have an explicit #-of-Temp-RS-bursts field either. |
| vivo | We are not supportive to this proposal, as it does not resolve the misalignment issue – if the gNB tends to take the conservative configuration, the flexibility of RRC configuration is anyway meaningless. |
| ZTE | Although we won’t object the direction of indicating the number of bursts via RRC. However, we still don’t understand the consequence if the number of bursts is not indicated to the UE (Opt 3.1.4). Network can transmit the TRS for a certain number of times and UE is not required to receive all the TRS as long as the RAN4 requirements is satisfied.  Regarding the proposal, the revision from Qualcomm is ok for us. |
| MTK | We support Qualcomm’s revision. Also fine with Ericsson2’s version. |
| Futurewei2 | Regarding the potential issue of misaligned information on the known/unknown cell, we think at least for some typical cases, there is no such issue:   * Known for sure: e.g., the SCell was deactivated a few tens of ms ago, or the measurement cycle is short enough; * Unknown for sure: e.g., the SCell was deactivated a few seconds ago, and the measurement cycle is long.   So a configurable number of bursts can still be useful in these cases. Only for cases in between, the gNB can be conservative.  Also as we commented before, the type(s) of the temporary RS burst(s) may also be needed, such as one or more SSB bursts followed by one or more TRS bursts. So our suggestion based on Qualcomm’s version is:  ***Proposal 3****: For efficient activation of a Scell, the number(s) and type(s) of temporary RS bursts are ~~is~~ ~~implicitly~~ indicated by a field in new MAC-CE*   * *The number(s) and type(s) of temporary RS bursts are ~~is~~ RRC configurable.* * *~~The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of the number of temporary RS bursts~~* * *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS* |
| Apple | We are in general ok for this proposal assuming it targets for known SCell case and there is no misalignment between gNB and UE.  On the other hand, as commented earlier, we think it is also important to clarify what is the expected UE behavior if the misalignment between gNB and UE regarding ‘known’ vs. ‘unknown’ SCell state happens. More especially, does UE fallback to legacy SCell activation procedure based on SSB in this case? Or something else? Depending on the answer, we can go with the proposal if fallback is allowed or mandating a fixed number of bursts based on the ‘unknown’ SCell case. |
| CATT | Support the version from Qualcomm. |
| Moderator | @Spreadtrum, it was for a SCell as the main bullet. But since the second subbullet becomes a FFS now, the field may represent multiple SCell, like the configured list of trigger states for A-TRS. Or a simple configured list for each SCell, and the field is per SCell to indicate one entry of the list.  @OPPO, @Apple, regarding the state of known SCell and unknown SCell, in my understanding, a gNB is aware of the SCell state of a UE for most of time because its state is clearly specified in TS 38.133. But in some short duration when transient duration occurs for the state switching, a gNB may overestimate the SCell state of a UE. This issue can be solved by RAN4 where the concept of the known SCell was introduced. For example, the new requirements of activation time is only applicable when the right number of bursts is provided. In the worst case, the activation time is longer than than a gNB expects, but it seems no particular harm to the gNB. In the other cases, the indicated number of bursts is still beneficial.  @Ericsson, if the second bullet needs more discussions, it would be better to put a FFS for it, in order to make it clear what would be further discussed.  ***Proposal 3-v2****: For efficient activation of a Scell, the number of temporary RS bursts is ~~implicitly~~ indicated by a field in new MAC-CE*   * *The number of temporary RS bursts is RRC configurable.* * *FFS: the association between the field and the number of bursts, e.g. the field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of the number of temporary RS bursts* * *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS* |

**Issue-3.2: Gap between two temporary RS bursts**

Opt 3.2.1: Configured by RRC. [3]

Opt 3.2.2: Indicated in the MAC CE. [1]

**Question 3.2: Which option above should be selected if two temporary RS bursts are triggered? Your views on benefit/gain, specification impact, implementation complexity are encouraged.**

Companies’ views are very welcome.

|  |  |  |  |
| --- | --- | --- | --- |
| *Company* | | *View* | |
| Qualcomm | | For each triggering state, a temporary RS that comprises one or two bursts with a gap is configured by RRC. Then, the actually used triggering state is indicated by MAC-CE triggering ignaling for the temporary RS to be transmitted. This is a combination of Opt.3.2.1 and Opt.3.2.2 and similar to legacy A-CSI-RS/A-TRS triggering via UL DCI. | |
| Futurewei | | As suggested above, we can be open but suggest to clarify RAN4 inputs first. | |
| ZTE | | We share similar view with Qualcomm for this issue.  Regarding how to define/configure the gap via RRC, it is next-level detailed discussion. | |
| OPPO | | Based on preliminary information from RAN4, a gap or minimum of the gap by RRC configuration should be sufficient. But let’s wait for RAN4’s final decision on the gap. | |
| Vivo | | We prefer Opt 3.2.1, considering the flexibility especially in the case of dynamic TDD operation, where the gap may need to be adaptive to the SFI. | |
| CATT | | Same view as Qualcomm. | |
| MTK | | We think using RRC configuration is enough. | |
| NEC | | We prefer to wait for RAN4’s final decision on the gap. | |
| Intel | | Same view as Qualcomm. | |
| Nokia | | Same view as Qualcomm. | |
| Ericsson | | Prefer to wait for RAN4 input | |
| Samsung | | Wait for RAN4 input. | |
| NTT DOCOMO | | Same view as Qualcomm. | |
| Apple | | Same view as Qualcomm | |
| Moderator | | Thank you for the feedbacks.  9 companies prefer RRC configuration or RRC-dependent methods. companies prefer to wait for more RAN4 inputs on the gap. According to the discussions, the outcome seems to only impact on RRC, so **let’s suspend the discussion** till more RAN4 inputs are received and concrete designs are done. | |
| Moderator | | Thank you for the feedbacks.  9 companies prefer RRC configuration or RRC-dependent methods.  4 companies prefer to wait for more RAN4 inputs on the gap.  According to the discussions, the outcome seems to only impact on RRC, so **let’s suspend the discussion** till more RAN4 inputs are received and concrete designs are done. | |

#### Issue-4: Triggering offset of temporary RS

When temporary RS is triggered, the triggering offset between a reference slot and the slot in which the temporary RS is transmitted should be discussed. Two issues and corresponding companies’ views are summarized. Detailed restriction of triggering offset can be discussed as soon as this issue is completed.

**Issue 4.1: Reference slot for triggering offset of temporary RS**

Opt 4.1.1: The slot carrying HARQ-ACK information for the triggering MAC CE.[1][5][6][9][10][15][18][19][20][21]

Opt 4.1.2: The slot containing the MAC CE that triggers Scell activation and temporary RS. [3][8][17]

Opt 4.1.3: Last downlink slot on the to-be-activated cell overlaps with n+k defined in TS38.213. [2][7]

**Question 4.1: when considering the triggering offset of temporary RS, which reference slot is preferable?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | As we presented in our contribution, using HARQ-ACK feedback timing as the reference for temporary RS triggering timing may cause scheduler complexity especially for the case of PDSCH re-transmission. However, from UE viewpoint there is less motivation to optimize the case. Hence we can live with Opt.4.1.1. |
| Futurewei | The options are not fundamentally different from each other, as they differ by pre-determined gaps. For example, the different between the ACK and slot n+k is a fixed 3 ms delay. In addition, we do not think any DL transmission can be reliably received by the UE before n+k, so n+k can be used as the reference. Then we suggest to stick with the existing RAN1 spec of n+k. |
| ZTE | As analyzed in our contribution, there are many other options for this issue, e.g., Opt 4.1.1+3ms. But we are ok with Opt 4.1.1. |
| OPPO | 4.1.1. |
| vivo | Opt 4.1.1 |
| CATT | We also support option 4.1.1.  But as we mentioned in our contribution, the slot carried HARQ-ACK is defined with reference of UL slot. It needs to translate to downlink slot as the TRS is transmitted by gNB. Accordingly, it should be updated as below:  Opt 4.1.1: The last downlink slot overlaps with the slot carrying HARQ-ACK information for the triggering MAC CE. |
| MTK | Opt 4.1.2. This is the most straightforward reference slot. |
| InterDigital | Option 4.1.1 |
| NEC | Opt 4.1.1. |
| Intel | Opt 4.1.1 |
| Nokia | We are suggesting 4.1.2, because as long as what the gNB does is send MAC-CE + TRS, then the possible additional overhead of perhaps 10% of the time sending unnecessary TRS is diminished by the simplicity and the potentially reduced timeline. With this there is no ambiguity between the UL and DL slots either, something that has been causing quite some grief in both Rel-15 and Rel-16 maintenance. |
| Ericsson | We prefer Option 4.1.3, (which seems to be similar to Futurewei suggestion). Indeed using 4.1.1 leads to additional scheduler restrictions and may need new triggering offset value range (since offsets that lead to < 3ms are unused). This can be avoided by just aligning to existing RAN1 spec of n+k. |
| Samsung | The slot after the Scell is activated as defined by the Rel-16 timeline for the MAC CE. The HARQ-ACK timeline can result to TRS transmission prior to Scell activation. |
| NTT DOCOMO | Ok with Opt 4.1.1 |
| Apple | Opt.4.1.1 |
| Moderator | The majority of companies prefers Opt 4.1.1.  Two companies prefer 4.1.2, thinking it is more straightforward.  Two companies prefer 4.1.3, reusing the RAN1 spec of n+k as reference.  CATT suggested to clarify a bit the Opt 4.1.1 that it is the last DL slot overlapping with the UL slot of HARQ-ACK. It is helpful for the case with different numerology. Considering TA for the UL slot, it seems better to clarify further that it is the nominal DL slot overlapping with the UL slot.  Since there is no fundamental difference, we could go with the majority view.  @Ericsson, **could you please elaborate a bit** the additional scheduler restriction that you concerned? |

##### FL proposal

With above summary, a potential proposal is,

***Proposal 4-1****: For efficient activation of a Scell, the reference slot for triggering offset of temporary RS is the last nominal DL slot of the to-be-activated Scell overlapping with the UL slot carrying HARQ-ACK information for the triggering MAC CE.*

Comments are welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Spreadtrum | Support |
| Ericsson2 | To respond to the FL question, current triggering offset value range is between 0 to 31 slots, and MAC CE application time is 3ms after the slot in which the HARQ-ACK (for the PDSCH containing the MAC CE) is received.  Thus, if option 4.1.1. is chosen, for FR2 cells, the triggering offset values between 0-23 are essentially unusable, and only 24-31 is possible, which will mean gNB has a narrow window of about 1ms in which it can schedule A-TRS instead of about 4ms window with Option 4.1.3.  Therefore, our preference is 4.1.3. |
| OPPO | Agree |
| Qualcomm | OK with the proposal. Regarding the Ericsson’s concern, is it sufficient to define the RRC parameter that indicates the offset with the range starting from 24? (this is assuming 3ms is the minimum offset). |
| Intel | We support FL proposal. |
| Nokia | We would prefer option 4.1.3, as that way the timing relation is behind one variable rather than two in relation to the command. That said, we don’t think the issue is critical and if there is strong desire for many to go with the FL proposed 4.1.1, we can accept that. |
| Vivo | Support |
| ZTE | We are ok with either the FL proposal or Option 4.1.3. |
| MTK | We still prefer Option 4.1.2 but can go with FL’s proposal or Option 4.1.3 if that’s the majority preference. |
| Futurewei2 | We fail to understand why a new reference slot needs to be introduced here. Opt. 4.1.1 and 4.1.3 differ by a fixed 3 ms, and 4.1.3 is already specified in existing standards. Unless we missed something, 4.1.3 should be the obvious way to go. It would be a messy solution if RAN1 creates 2 different reference slots for gNB / UE to keep track of. |
| Apple | Support FL’s proposal.  Regarding the concern on ~1ms window for temporary RS arrangement, it transfers into 8 slots in FR2, which seems to provide good flexibility. Extending to a larger value e.g., 32 slots would increase the SCell activation latency and contradict with the function of this enhancement. |
| CATT | Support FL’s proposal. But the ‘nominal’ should be deleted as the reference slot should be an actual downlink slot as it is associated with TRS transmission. |
| Moderator | @Ericsson, Thank you for your reply. Not sure if we have already had consensus on the earliest slot for the transmission of temporary RS. Your concern seems based on the earliest slot is 3ms after the slot carrying HARQ-ACK and the range of the indicated offset starts only with 0. Such assumption or premise may not be accepted by majority of companies yet. Therefore, let’s try to put a FFS to resolve your concern.  @CATT, as explained before, the word “nominal” is to clarify the TA issue. If it is actual downlink slot, do you mean the actual slot at the UE side or gNB side?  ***Proposal 4-1-v2****: For efficient activation of a Scell, the reference slot for triggering offset of temporary RS is the last nominal DL slot of the to-be-activated Scell overlapping with the UL slot carrying HARQ-ACK information for the triggering MAC CE.*   * *FFS: the earliest slot for a UE to receive a triggered temporary RS* * *FFS: how to fully utilize the value range of indicated triggering offset, e.g. the range starting with non-zero value, or predefined offset in addition to the indicated triggering offset.* |
| Nokia | We did propose a different approach, but we can accept proposal 4-1-v2 |
| Qualcomm | OK with Proposal 4-1-v2 |
| CATT | TA is a per-UE aspect when UE transmit uplink channels which intend to make sure a same timing can be achieved at gNB side. The ‘nominal DL’ terminology is quite misleading. I am not sure why and how to take TA into consideration for DL transmission. From our understanding, the actual DL slot should of course be determined at gNB side. The TA should be considered by UE when it transmits UL signals. I don’t see difference from the other DL channels when we are talking about DL slot for T-RS. |

**Issue-4.2: Indication of triggering offset**

Opt 4.2.1: Configured by RRC. [2][3][5][6][16][18][21]

Opt 4.2.2: Indicated in new MAC CE. [1][2][5][10][15][17][18][20]

Opt 4.2.3: Indicated by the PDCCH scheduling the PDSCH carrying the MAC CE. [10]

**Question 4.2: which option should be supported for triggering offset indication?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | Same as A-CSI-RS triggered by a DCI, for each triggering state, offset value is configured by RRC. The MAC CE indicates a triggering state for the temporary RS to be transmitted. This is a combination of Opt.4.2.1 and Opt.4.2.2 and similar to legacy A-CSI-RS/A-TRS triggering via UL DCI. |
| Futurewei | Option 4.2.1 / 4.2.2. |
| ZTE | We share similar view as Qualcomm for this issue. The legacy triggering offset configuration can be reused. |
| OPPO | The total offset (from MAC-CE to temporary RS) can contain two delays:   * The delay from triggering MAC-CE to its corresponding HARQ-ACK is given by PDCCH scheduling the PDSCH carrying the MAC-CE; * The delay from HARQ-ACK to temporary RS transmission is configured by RRC.   It should be noted that these two delays may be counted based on different SCS – the 1st delay may be based on SCS in the serving cell where UE receives activation MAC-CE, and the 2nd delay may be based on SCS in the to-be-activated SCell. |
| vivo | Opt 4.2.2 (1st preference), Opt 4.2.1 (2nd preference) |
| CATT | Same view as Qualcomm, Option 4.2.1 + Opition 4.2.2 |
| MTK | Opt 4.2.2. |
| InterDigital | Combination of Opt. 4.2.1 and Opt. 4.2.2 |
| NEC | Opt 4.2.2. |
| Intel | Opt 4.2.2. |
| Nokia | Combo of 4.2.1 and 4.2.2, i.e. agree with Qualcomm et al. |
| Ericsson | Opt 4.2.1 |
| Samsung | Opt 4.2.1 – offset value is configured by RRC. The triggering state maps to an RRC-configured offset. |
| NTT DOCOMO | Opt 4.2.1 + Opt 4.2.2. Same view as Qualcomm. |
| Apple | Combination of Opt.4.2.1 and Opt.4.2.2. |
| Moderator | The majority of companies (7 companies) prefers to a combination of Opt 4.1.1and Opt 4.2.2  2 companies for Opt 4.2.1  4 companies for Opt 4.2.2 |

With above summary, a potential proposal is,

***Proposal 4-2****: For efficient activation of Scells, the triggering offset of temporary RS is implicitly indicated by a field in new MAC-CE*

* *The value of triggering offset is RRC configurable*
* *The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of triggering offset*
* *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS*

Comments are welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Spreadtrum | Separate fields for triggering offset and bursts number in proposal 3, or one field for two indication? |
| Ericsson2 | We suggest removing the second bullet as details of the association needs further discussion. For example, a triggering state list mechanism is still possible, and the field of MAC CE can indicate multiple TRSs, each with a different triggering offset.  ***Proposal 4-2****: For efficient activation of Scells, the triggering offset of temporary RS is implicitly indicated by a field in new MAC-CE*   * *The value of triggering offset is RRC configurable* * *~~The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of triggering offset~~* * *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS* |
| OPPO | We would like to see how this RRC configuration framework is managed, such as how many RRC configuration entries are eventually needed, given several proposals (not only proposal 4-2 but also others) follow the same logic of candidate-by-RRC and selection-by-MAC-CE. It is better to have the full picture first, rather than agreeing to add combinations one by one, without knowing how the whole thing can be manageable. |
| Qualcomm | Same as the previous one – generally OK but suggest to delete “implicit”.  ***Proposal 4-2****: For efficient activation of Scells, the triggering offset of temporary RS is ~~implicitly~~ indicated by a field in new MAC-CE*   * *The value of triggering offset is RRC configurable* * *~~The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of triggering offset~~* * *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS* |
| Intel | It is confusing to use ‘implicitly’. Does it mean that the triggering offset are jointly indicated with other configurations of temporary RS by a field in new MAC CE? We prefer a separate field in MAC CE for flexibility |
| NTT DOCOMO | We are generally fine with the proposal. The wording of “implicit” might be misunderstood and can be deleted. |
| Nokia | Generally OK, and can also accept the proposed revisions. |
| vivo | Fine with Qualcomm’s revision |
| ZTE | Generally OK, we prefer the updated version from Qualcomm based on Ericsson’s previous version. |
| MTK | We are fine with QC or Ericsson’s revision. |
| Futurewei2 | The proposal does not clearly describe the case that, for a SCell, there could be one or more configured offsets and the MAC CE can select one of them. This needs to be clarified.  Also the FFS seems to be repetitive of previous proposals. We suggest to remove it.  ***Proposal 4-2****: For efficient activation of Scells, for each to-be-activated SCell, the triggering offset of temporary RS is ~~implicitly~~ ~~indicated~~ selected by a field in new MAC-CE from one or more values of triggering offsets configurable by RRC*   * *~~The value of triggering offset is RRC configurable~~* * *~~The field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of triggering offset~~* * *~~FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS~~* |
| Apple | Support Futurewei’s modification. |
| CATT | Support Futurewei’s modification. |
| Moderator | @OPPO With revision from Ericsson and Qualcomm, the current proposal is only about the necessity of the indication by a MAC-CE, but its association between the offset value and the MAC-CE field is FFS. For example, it can be similar to the triggering of A-TRS, or a configured list with multiple resource ID of temporary RS for a SCell, and the field represents the resource ID in the list. Different offset corresponds to different resource ID.  @Ericsson, if the second bullet needs more discussions, it would be better to put a FFS for it, in order to make it clear what would be further discussed.  ***Proposal 4-2-v2****: For efficient activation of Scells, for each to-be-activated SCell, the triggering offset of temporary RS is ~~implicitly~~ ~~indicated~~ selected by a field in new MAC-CE from one or more values of triggering offsets configurable by RRC*   * *~~The value of triggering offset is RRC configurable~~* * *FFS: the association between the field and the offset, e.g. the field of new MAC-CE is associated with an entity of a configured list where every entity can have different value of triggering offset* * *FFS: the exact associated field in the MAC-CE, e.g. the triggering state ID of temporary RS* |

##### FL proposal

According to the discussion for issue-3 at GTW session, the proposal is revised a bit,

***Proposal 4-2-v3****: 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 value of triggering offset is RRC configurable*
* *FFS: which field in MAC-CE is used and how this field is associated with the value of triggering offset*

Any comments are welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Nokia | Support the proposal. Some level of dynamics makes it easier to schedule the temporary RS around e.g. UL slots or SSB bursts. |
| Qualcomm | OK with Proposal 4-2-v3 |
| CATT | We are fine with the proposal. |
|  |  |

#### 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 should be 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. [9]

“*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 [3][7]

**Question 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?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | Yes |
| Futurewei | A better and more complete solution exists.  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.  For example, if the P/SP TRS is also available, QCL Type A between P/SP TRS and the temporary RS would be preferred over QCL Type C between SSB and the temporary RS. |
| ZTE | OK |
| OPPO | The WA reads as “something can be indicated [from gNB to UE] in case of known SCell”, which describes a gNB behavior of “indication” conditioned upon a status on UE side. But the gNB actually cannot ensure whether the SCell is known to UE because some RAN4 conditions not reported to gNB could turn the SCell into unknown status for the UE.  We see some inconsistency between this WA and RAN4 spec, and therefore do not support confirming the WA. This WA is not a must-have for fast SCell activation. |
| vivo | OK |
| CATT | Yes |
| MTK | No. Same concern as OPPO, how does gNB know whether the SCell is known to UE or not? |
| InterDigital | Confirm |
| Intel | OK to confirm the WA |
| Nokia | Yes |
| Ericsson | Keep the WA |
| Samsung | OK in principle but ACK to the comments by OPPO and MTK that “known SCell” needs to be described from a RAN1 perspective. Can revisit after defining what a “known SCell” is and how the gNB and the UE can have same understanding. |
| NTT DOCOMO | Ok |
| Apple | Yes |
| Moderator | Main concern:   * Potential misalignment between gNB and UE on the known/unknown state of a SCell at the UE. The gNB may have to take a conservative strategy on the number of bursts of temporary RS.   Companies are encouraged to share more views to address this concern. |
| vivo | Our view to this misalignment issue is same as that for the number of temporary RS bursts. Due to the potential misalignment, the gNB triggers the temporary RS with two bursts. Similarly, the gNB can anyway indicates the assistant SSB, and the UE can decide whether to make use of it according to the actual known/unknown state. |
| OPPO | What vivo suggested can be a work-around. However, the behavior in vivo’s suggestion is different from the earlier WA. The difference is about whether the known-Scell condition is linked to “gNB indicates the QCL relation” or “UE makes use of QCL relation”. The new formulation reflecting vivo’s logic is:   * *UE can make use of a SSB of to-be-activated SCell as QCL source of temporary RS when the to-be-activated SCell is a known SCell.*   + *It is assumed to be gNB’s responsibility to ensure the feasibility of above UE behavior without knowing whether the to-be-activated SCell is known or unknown to the UE.* |

**Issue-5.2: 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, 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. [3][4][5][7][16][19]

**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.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | Yes |
| 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. |
| ZTE | Opt 5.2.1, which is the same as legacy mechanism. |
| vivo | Opt 5.2.1 |
| CATT | Yes |
| NEC | Opt 5.2.1 |
| Intel | Yes |
| Nokia | Opt 5.2.1 |
| Ericsson | As described in Opt 5.2.1 |
| Samsung | Opt 5.2.1 |
| NTT DOCOMO | Opt 5.2.1 |
| Apple | Opt 5.2.1 |
| Moderator | Consensus seems achieved.  One company suggests to cover the other cases, e.g. QCL between P/SP TRS and the temporary RS. Companies’ comments on this are welcome. |
| vivo | We would like to first understand what the issue is for the case, e.g., P-TRS. Isn’t the Rel-15/16 QCL still workable for determining QCL for P-TRS? |

##### FL proposal

With above summary, a potential proposal is,

***Proposal 5****: For efficient activation of a Scell, if a SSB of the to-be-activated SCell is indicated as a QCL source for the temporary RS in case of known SCell, the QCL type is expected to be*

* *‘typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block*

Comments are welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| vivo | Our view to this misalignment issue is same as that for the number of temporary RS bursts. Due to the potential misalignment, the gNB triggers the temporary RS with two bursts. Similarly, the gNB can anyway indicates the assistant SSB, and the UE can decide whether to make use of it according to the actual known/unknown state.  We would like to first understand what the issue is for the case, e.g., P-TRS. Isn’t the Rel-15/16 QCL still workable for determining QCL for P-TRS? |
| Qualcomm | The proposal is fine.  In general, we do not think we should design the temporary RS based fast SCell activation for general unknown cell (i.e., unknown cell without known cell in the same band).  Unknown cell condition includes everything other than known cell conditions, e.g., fully blind activation (the UE has never measured/find the cell) is included as one case of unknown cell. For FR2 (or for BF), the network has to transmit temporary RS bursts many times so that the UE can AGC and time/frequency tracking sweep Rx beams. For example, in R4-1814877, MediaTek mentioned regarding legacy SSB-based SCell activation for unknown cell case in FR2: “For the case if there is no active serving cell on that FR2 band, it assumes N=8 for RX beam sweeping, 2 SSB samples for AGC per RX beam, 1 SSB sample for cell search per RX beam, and one SSB sample for fine sync without RX beam sweeping. And for AGC it should be based on TSMTC,max then Tactivation\_time is [3ms+ 16\*TSMTC,max + 9\*TSMTC + 2ms]”. Doing the same thing by temporary RS requires a lot of bursts. Supporting huge number of temporary RS bursts is not feasible and is not aligned with the principle of the temporary RS based fast SCell activation. |
| Intel | We support FL proposal |
| Nokia | We are OK with the proposal, and have generally the same sentiment as Qualcomm. |
| ZTE | We are ok with the FL proposal. |
| MTK | We are fine with the FL proposal.  Regarding QC’s comment on unknown cell, we think one possibility to support the huge number of RS is using a condensed PSS/SSS burst for FR2 unknown cell. Besides, the temporary RS cost for FR1 unknown cell would be much more manageable compared to FR2 and can be considered first if unknown cells are to be visited later. |
| Futurewei2 | As commented before, generally P/SP-TRS can be a better QCL source if available, and we do think in typical cases, P/SP-TRS are configured. In this sense, this proposal is a bit incomplete. |
| Apple | Fine with the proposal. |
| CATT | Fine with the proposal. |
| Moderator | @vivo, regarding the misalignment issue of known/unknown SCell, it can be resolved by the definition of RAN4 requirements. Please refer to my reply to OPPO comments under FL proposal 3 (Section 3.2.1.2.1). I may not fully understand your second comment on P-TRS, here is about temporary RS instead of P-TRS. Could you please elaborate it a bit? |

**Issue-5.3: For unknown SCell case, whether the SSB/P-TRS of another active cell** **can be indicated as a QCL source for the temporary RS?**

* **Opt 5.3.1:** Yes [3][7]
* **Opt 5.3.2:** No

**Question 5.3: For unknown SCell case, whether the SSB/P-TRS of another active cell** **can be indicated as a QCL source for the temporary RS?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | We have not agreed to support unknown SCell case. We do not think we should agree this level of question. |
| Futurewei | We should follow RAN4 inputs. If AGC/cell detection/tracking rely on an activated serving cell in the same band, or rely on a contiguous activated serving cell in the same band, then yes.  We also note that the cross-carrier QCL is bi-directional, i.e., if cell 1’s SSB can be a QCL source for cell 2’s temporary RS, cell 2’s SSB can also be a QCL source for cell 1’s temporary RS. So to configure/assume cross-carrier QCL, association between the SSBs for the carriers may be considered. That is, SSB 1 in cell 1 is QCLed with SSB 2 in cell 2, or vice versa. The UE does not really need to utilize one SSB to receive the other SSB, but the QCL relation is to inform the UE that cross-carrier QCL can be assumed. With the SSBs associated with each other, the other signals QCLed to SSB can be assumed to have implied QCL relationships with the cross-carrier SSB. |
| ZTE | This may need further RAN4 input. As indicated in the LS, RAN4 is still studying the unknown SCell case. |
| OPPO | Need further RAN4 input. The current RAN4 message is that, even with the existence of an active serving cell in the same band, RAN4 still assumes temporary RS of at least one burst is needed on the to-be-activated cell for time/frequency tracking. RAN4 provides no hint showing that even the time/frequency tracking functionality can also be moved from to-be-activated cell to active-serving-cell. |
| vivo | Wait for RAN4’s responses before answering this question. |
| CATT | Yes. For the unknown cell, RAN4 already announce the feasibility if some conditions are met, e.g. there is an active cell for intra-band continuous CA. At least for the available scenarios for unknown cell, SSB on another active cell can be considered as the QCL source for the temporary RS. |
| MTK | Yes. Same view as Futurewei/CATT. |
| Intel | Need further RAN4 input. |
| Nokia | Wait for RAN4 |
| Ericsson | Similar view as Qualcomm |
| Samsung | Wait for RAN4 – also relates to issue/question 5.1 |
| NTT DOCOMO | Wait for RAN4 |
| Apple | Wait for RAN4 |
| Moderator | The majority of companies prefers to wait for more RAN4 inputs. Let’s suspend this discussion. |

#### Issue-6: Associated BWP for temporary RS

All the BWP(s) configured on a cell are inactive before the cell is activated. If a UE measures the triggered temporary RS during SCell activation procedure, the measurement on the target BWP should be allowed despite of the activation state of the BWP. On which BWP the UE measures the temporary RS should be considered. Companies’ views are summarized as follows:

* **Opt 6.1** The BWP configured by “*firstActiveDownlinkBWP-Id”*. [5][9][15][16][18] [7]
* **Opt 6.2** gNB indicates the BWP along with the indication of triggering the temporary RS. [7][19]

**Question 6: Which option listed above is preferable? Your views on benefit/gain, specification impact, implementation complexity are encouraged.**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | Opt.6.1 |
| Futurewei | We are fine with Opt 6.1 as the baseline.  In addition, as a configured TRS is associated with a BWP ID, when a specific TRS is selected by the MAC CE (if supported), the BWP associated with the TRS is selected to be the active BWP |
| ZTE | We understand that Opt 6.1 is more aligned with the legacy mechanism and Opt 6.2 offers more flexibility for the network. We slightly prefer 6.2. |
| OPPO | Opt 6.1.  It seems possible that, even if the gNB wants the UE to work on Rel-17 SCell activation, the UE may still decide to follow legacy SCell activation (the known vs. unknown SCell could be one of reasons). Therefore it is beneficial to maintain the legacy UE behavior on this BWP determination to avoid the potential BWP mis-match between gNB and UE. |
| vivo | Opt 6.1.  Regarding Opt 6.2, we would like to be clarified, does it propose to change the SCell activation behavior as well (e.g., the first activated BWP is no longer the one with *firstActiveDownlinkBWP-Id*)? If not, what is the motivation of Opt 6.2? |
| CATT | Our position has already been updated in our document. We are also fine with Option 6.1. |
| MTK | Opt 6.1 |
| InterDigital | Option 6.1. |
| NEC | Option 6.2 offers flexibility to the network. We are also fine with Opt 6.1. |
| Intel | Opt 6.1 |
| Nokia | 6.2 could be beneficial, but we are OK with 6.1 as well |
| Ericsson | Opt 6.1 |
| Samsung | Option 6.1 – that is the purpose of *firstActiveDownlinkBWP-Id* |
| NTT DOCOMO | Opt 6.2 can provide gNB flexibility. We are also fine with Opt 6.1. |
| Apple | Opt. 6.1 |
| Moderator | Thank you for your feedbacks.  Opt. 6.1 is supported by majority of companies.  However, FutureWei raised a good point, it is good to discuss further the following   * Similar to the CSI-RS configuration, is there any BWP ID configured with the indicated resource of temporary RS? * If yes, how to handle the BWP ID associated with the indicated resource of temporary RS and its relationship with Opt. 6.1?     Your comments are welcome. |
| Qualcomm | What Moderator mentioned above is true. On the other hand, it is also true that the first BWP to be active when SCell activation is done is the BWP configured by *firstActiveDownlinkBWP-Id*. Since the whole functionality here is targeting “SCell activation” and not “BWP-switching”, we think Opt.6.1 is appropriate. Detailed RRC signalling can be discussed further later on. |

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

#### Issue-7: Tactivation reduction with BS assistance but no temporary RS nor SSB

It is proposed in [2][3] 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 7: 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* |
| Qualcomm | As described in the table of Section 3.2.1.2 of this summary, RAN4 has already specified different latencies for different conditions including use of using other active serving cell in the same band. It is not clear what is actually considered in this proposal. We suggest to de-prioritize this discussion. |
| Futurewei | We can follow RAN4 inputs. |
| ZTE | It seems RAN4 is in the place to answer the question. If RAN4 confirms that it is beneficial, then RAN1 decides whether to support it and if yes, then RAN1 works on the potential RAN1 spec impact. |
| OPPO | The RAN4 reply LS seems already say NO.  The current RAN4 message is that, even with the existence of an active serving cell in the same band, RAN4 still assumes temporary RS of at least one burst is needed on the to-be-activated cell for time/frequency tracking. RAN4 provides no hint showing that even the time/frequency tracking functionality can also be moved from to-be-activated cell to active-serving-cell.  From RAN1 perspective, the SCell activation based on RS from an active serving cell is a 3rd solution besides the legacy SSB-based activation and Rel-17 A-TRS based activation. We do not see a strong need for RAN1 to seek the 3rd solution before completing what is already agreed to handle in Rel-17. |
| vivo | Wait for RAN4’s input before answering this question. |
| MTK | We are not able to link this proposal to current RAN4 reply. More discussion is needed. |
| Intel | Wait for RAN4’s input |
| Samsung | Wait for RAN4 and deprioritize. |
| NTT DOCOMO | Wait for RAN4’s input. |
| Apple | Prefer to wait for RAN4 further Input. |
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## TCSI\_reporting reduction

### Issue-8: Enhancement for CSI reporting

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

* **Opt 8.1** New MAC-CE command that triggers the SCell activation and A-TRS transmission is used to additionally trigger A-CSI-RS transmission. [15]
* **Opt 8.2** The temporary RS may be enhanced to support CSI measurement. [10]
* **Opt 8.3** short interval P/SP- CSI-RS report. [3]

“*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 8.4** remove TCSI\_reporting for the case of FR2 unknown cell. [3]

“*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 8: which options above of CSI reporting enhancement should be supported?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | We do not think any of them should be discussed right now. |
| Futurewei | We suggest to include AP CSI-RS triggering into the new activation framework. Unless RAN1/RAN4 can agree on Opt 8.4, SCell activation bottleneck may be the CSI acquisition / reporting in some cases. Further enhancements can be discussed. |
| ZTE | Currently, our understanding is that the legacy CSI reporting mechanism can be reused without any issue. This issue can be deprioritized and discussed later once if any issue has been figured out for the current mechanism. |
| OPPO | Share the same views from Qualcomm and ZTE. This topic should be deprioritized. |
| vivo | None. We don’t think it is necessary to discuss this issue currently. |
| CATT | It may be helpful if the valid CSI reporting can only associated with periodic CSI-RS. We are open to discuss the motivation and the detail solution. |
| MTK | We tend to think legacy CSI reporting mechanism can be reused. We are open to discuss more about Opt 8.3/8.4. |
| Intel | We think CSI report should be available ASAP in fast SCell activation. We are open for potential solutions |
| Nokia | We support investigating these mechanisms. |
| Samsung | No need to enhance CSI reporting – any delay reduction has an overall marginal impact to the SCell activation. This is meant to be less complex to operate than using dormancy/non-dormancy. |
| NTT DOCOMO | It can be deprioritized unless any issue is found. |
| Apple | Opt.8.1. Opt.8.3 is also ok for us but seems it causes larger overhead if a P-CSI-RS with a smaller period is always configured for this purpose. In general, we are open for any solutions to reduce CSI reporting latency.  As commented at the start, it is important to reduce CSI reporting by introducing aperiodic CSI-RS as part of fast SCell activation framework; Otherwise, CSI report would become bottleneck and make the whole feature less attractive. |

## General Issues

**Question G1:** 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. [2]

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | We do not think any of them should be discussed right now. |
| Futurewei | We think it is quite beneficial to include more AP RS transmissions into the new SCell activation framework. Unless RAN1/RAN4 can agree on Opt 8.4, SCell activation bottleneck may be the UL / DL CSI acquisition / reporting in some cases. Further enhancements can be discussed. |
| ZTE | We can come back to this once we found any issue with the current TRS as temporary RS. |
| OPPO | No, unless A-TRS alone is proved to be problematic and adding more types of RS does not make the problem even bigger or generate new problems. |
| vivo | Currently we don’t think any strong motivation for this. |
| CATT | It can be deprioritized. We think the current mechanism with introducing temporary RS is sufficient. |
| MTK | Yes. We think RS based on SSS/PSS as temporary RS is beneficial for unknown SCell activation since cell detection is needed. |
| Intel | Agree to deprioritize it in the moment |
| Nokia | The context of this is somewhat unclear, e.g. if PSS/SSS are transmitted as part of normal SSB broadcast, they are there and can be used, but are not part of Temporary RS. If we are talking of in addition to the TRS, also transmitting some other aperiodic signal, the motivation is missing. Transmitting SRS as additional TRS seems the most puzzling. We don’t quite understand the direction of this |
| Samsung | Deprioritize |
| NTT DOCOMO | It can be deprioritized unless any issue is found. |
| Apple | We support A-CSI-RS to reduce the CSI reporting latency. |
| Moderator | No enough support. This discussion is deprioritized. |

**Question G2:** If NACK is received for the PDSCH carrying the MAC-CE triggering a temporary RS, whether additional adjustment is necessary? [8]

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | This is a potential issue if we agree HARQ-ACK timing or MAC-CE timing as a reference timing to determine temporary RS transmission timing. As long as the reference timing is relative to the scheduler decision, the gNB has to take care of temporary RS trigger for the case of re-transmission. |
| Futurewei | This seems to be a gNB implementation issue; in general the gNB should just re-send and wait until an ACK to prepare for temporary RS transmission, which would be occur until 3 ms later at least according to existing specs. Not sure what needs to be done here. |
| ZTE | Based on our understanding, the Rel-15/Rel-16 SP CSI reporting MAC-CE has the same issue. It can be left to the network implementation. |
| OPPO | The question is asked for gNB behavior. Then it is gNB implementation issue, as other companies suggested. |
| vivo | This question is highly dependent on other issues, such as Issue 3, Issue 4, etc. Generally, we think network implementation can handle this. |
| CATT | We share the same issue that it can be up to gNB implementation. If NACK is received, the MAC-CE can be re-transmitted by the gNB. |
| MTK | We also think this is up to gNB implementation. |
| NEC | This is a gNB implementation issue. |
| Intel | Prefer to up to gNB implementation to handle it |
| Nokia | Not an issue. A NACK means the UE did not receive anything, if the gNB anyway sends the TRS, then that is overhead that the UE doesn’t know about. The UE can only act on a correctly received MAC-CE and if that is a reference for the operation then only correctly received MAC-CE can act as a reference. The spec would be written from the receiver perspective and the incorrectly received MAC-CE does not exist in the specs, gNB handles it the way it sees fit. |
| Samsung | gNB can handle as for any NACK (whether or not a MAC CE is involved) |
| NTT DOCOMO | We also think it is up to gNB implementation. |
| Apple | Share views from ZTE and the situation exists already in Rel-15/16 and nothing is concluded/specified for it. Same handling should be used here i.e., left for gNB implementation. |
| Moderator | In majority view, it is up to gNB implementation. Let’s close this discussion. |

**Question G3:** Whether the existing Rel-16 A-CSI-RS/A-TRS triggering framework for temporary RS can be reused, or a new temporary RS trigger state list for SCell activation should be configured by higher layers?[8][21]

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | The question does not reflect our input. Please reflect our view to Issue 1 – Issue 4.  We propose to introduce a MAC-CE that has a trigger state field for each to-be-activated SCell. The trigger state field indicate one triggering state, where the triggering state is associated with a set of NZP-CSI-RS resource sets that comprises the temporary RS having one or two bursts. For each NZP-CSI-RS resource set, offset to identify the timing is configured. For each NZP-CSI-RS resources in the NZP-CSI-RS resource sets, TCI-state is configured. As such, the use of triggering state field is same as Rel-16 A-CSI-RS/A-TRS triggering framework. |
| Futurewei | Open for discussion later. |
| ZTE | Agree with QC that this issue can be discussed together with Issue 1 – Issue 4. Based on understanding, either reusing the legacy trigger state list or defining a new state list is workable. Even if we define a new list, most of the configurations are the same as what we have right now. We are ok to define a list for this issue. |
| vivo | It is highly dependent on the outcome of Issue 1-4. |
| MTK | Same view as ZTE. |
| Nokia | Agree that this is not an independent issue and should be resolved when the design is outlined in more detail |
| Samsung | Agree with Nokia |
| Apple | We support Qualcomm’s proposal. |
| Moderator | The issue can be discussed under issue#1 - #4. This discussion here is closed. |

## 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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| *Company* | *View* |
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# Conclusions

For GTW session,

***Proposal 1-v3****:*

*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 for each to-be-activated SCell.*
* *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 signaling 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*
* *Note: the number of temporary RS bursts has been agreed to be included.*

***Proposal 4-1****: For efficient activation of a Scell, the reference slot for triggering offset of temporary RS is the last nominal DL slot of the to-be-activated Scell overlapping with the UL slot carrying HARQ-ACK information for the triggering MAC CE.*

***Proposal 4-2-v3****: 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 value of triggering offset is RRC configurable*
* *FFS: which field in MAC-CE is used and how this field is associated with the value of triggering offset*

***Proposal 5****: For efficient activation of a Scell, if a SSB of the to-be-activated SCell is indicated as a QCL source for the temporary RS in case of known SCell, the QCL type is expected to be*

* *‘typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block*

# References

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2. [R1-2104206](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104206.zip) Support efficient activation/de-activation mechanism for Scells FUTUREWEI
3. [R1-2104234](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104234.zip) Discussion on efficient activation/de-activation mechanism for SCells Huawei, HiSilicon
4. [R1-2104342](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104342.zip) Discussion on Support Efficient Activation De-activation Mechanism for SCells in NR CA ZTE
5. [R1-2104393](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104393.zip) Discussion on efficient activation/de-activation mechanism for Scells vivo
6. [R1-2104447](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104447.zip) Discussion on efficient activation/de-activation mechanism for SCells in NR CA Spreadtrum Communications
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9. [R1-2104808](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104808.zip) Discussion on efficient activation/de-activation for Scell OPPO
10. [R1-2104933](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104933.zip) On efficient activation/de-activation for SCells Intel Corporation
11. R1-2104989 On efficient activation/de-activation for SCells Intel Corporation
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14. Withdrawn
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20. [R1-2105725](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2105725.zip) Discussion on efficient activation deactivation mechanism for Scells NTT DOCOMO, INC.
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22. [R1-2105846](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2105846.zip) Efficient activation/deactivation of SCell ASUSTeK

# Appendix: Agreements

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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 |