**3GPP TSG RAN WG1 #103-e R1-200xxxx**

**E-Meeting, October 26 – November 13, 2020**

**Agenda Item: 8.13.3**

**Source: Moderator (Huawei)**

**Title: [Draft] 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 11/5.

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

* 1st check point: 11/5
* 2nd check point: 11/10
* 3rd check point: 11/12

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 9 specific issues and 6 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 command for SCell activation/de-activation and temporary RS
* **Issue-2:** TRS structure for temporary RS
* **Issue-3:** QCL configuration of TRS
* **Issue-4:** Time-domain property of TRS
* **Issue-5:** Additional functionality of temporary RS during the SCell activation
* **Issue-6:** Timeline for temporary RS
* **Issue-7:** Associated BWP for temporary RS
* **Issue-8:** Tactivation reduction with BS assistance but no temporary RS nor SSB
* **Issue-9:** Enhancement for CSI reporting

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

* **Question G1:** Whether or not should temporary RS be introduced for unknown cells? [6][12][15]
* **Question G2:** Whether the accurate timing for SCell activation should be clarified or not [3], i.e. after which time points of time point#1, #2 and #3 in the Figure 1 of [3] is the to-be-activated SCell regarded as activated?
* **Question G3:** Whether or not to additionally support AP CSI-RS, P/SP CSI-RS, SRS, and RS based on SSS/PSS as temporary RS, one or more of which may be used during SCell activation depends on network configuration / UE capability. [1]
* **Question G4:** Whether or not RAN1 confirms the benefit of supporting periodic SRS on dormant BWP in Rel.17 and inform of it to RAN2. [17]
* **Question G5:** Whether The TRS for fast SCell activation consists of one TRS burst for AGC settling and another TRS burst for time/frequency tracking. [2]
* **Question G6:** Whether an LS to RAN4 is needed now, e.g. requesting performance requirements for TRS [10]

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 11/4 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: 11/5, and GTW session on 11/4

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

* **Issue-1:** Triggering command for SCell activation/de-activation and temporary RS
* **Issue-2:** TRS structure for temporary RS
* **Issue-3:** QCL configuration of TRS
* **Issue-4:** Time-domain property of TRS
* **Issue-5:** Additional Functionality of temporary RS during the SCell activation
* **Issue-6:** Timeline for temporary RS
* For 2nd check point: 11/10, and potential new GTW session
* **Follow-ups for all issues listed in 1st check point**
* **The remaining issues with potential consensus**
* 3rd check point: 11/12
* **Wrap-up for all 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 | We think we need to get some RF knowledges of time-domain/frequency-domain requirement to design the temporary RS. In particular, following questions need to be answered.   * If a temporary RS is used for AGC setting, what is the time-domain requirement on the temporary RS?   + Whether a TRS in one slot (=2 OFDM symbols in one slot) is sufficient, or a TRS in two consecutive slots (=4 OFDM symbols in the two slots) is necessary, or more? * If a temporary RS is used for AGC setting, what is the time-domain requirement for the gap between the RS for AGC setting and the RS for time/frequency tracking?   + Whether there is a necessary time gap between the OFDM symbols for RS for AGC setting and the OFDM symbols for RS for time/frequency tracking? * If a temporary RS is used for AGC setting, whether the temporary RS shall also be transmitted in the same slot on the active serving cell(s) in the same band?   + According to the definitions of TFirstSSB\_MAX and TSMTC\_MAX in the TS38.133 Section 8.3.2, RAN4 assumes that for AGC setting, SSBs are available in the same slot of all the active serving cells in the same band. We need to know whether the same is necessary for temporary RS.   We think this is relevant to Issue-2, Question G5, and Question G6. |
| Nokia, NSB | We agree that aspects of G5 and G6 should be part of priority topics and part of LS to RAN4. Also we think that Issue-6 could be discussed as soon as Issue-1 is resolved |
| ZTE | We share similar view with Qualcomm that we may need to send an LS to RAN4 to get some RF knowledge for AGC settling and T/F tracking. The questions raised by Qualcomm can be the starting point. |
| Samsung | We think Issue-5 (functionality) should be finalized first. After that, we can send an LS to RAN4 to get more information related to detailed requirements. |
| OPPO | Issue-5 should be finalized firstly.  Except questions proposed by Qualcomm, to be safe, we want to further check whether TRS structure, especially for frequency density, is enough for coarse time/frequency tracking. Note that frequency density for TRS structure is lower than that of SSB.  Although TRS can help UE get finer time/frequency tracking, however coarse time/frequency tracking is a premise. If there is no information on time/frequency, we do not know whether TRS structure is enough for coarse time/frequency tracking.   * If a temporary RS is used for coarse time/frequency tracking, Is TRS structure, especially for frequency density, enough?   + Whether to enhance TRS structure, especially for frequency density. |

# Discussions

**In this section, the issues with “2nd CP” are planned for the second check point (Nov. 10th) as summarized in Section 2.**

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 2, more detailed comments are welcome.



Figure 1 SCell activation procedure

## THARQ reduction

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

RAN1 can further develop the signaling for SCell activation/de-activation, some companies share views on this open issue and summarized as follows:

* **Opt 1.1** MAC CE (triggering only for SCell activation) [14][16]
* **Opt 1.1a** MAC CE (triggering for both SCell activation and temporary RS) [2][4][6][7][8][10][11][14][17]
* **Opt 1.2** DCI (triggering only for SCell activation) [12][16]
* **Opt 1.2a** DCI (triggering for both SCell activation and temporary RS ) [1][5][7][13][15]

**Question 1-1: Whether the triggering of temporary RS is integrated with SCell activation/deactivation trigger?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | Our view is more aligned with Opt.1.1a – above is corrected.  The answer is yes, but we may not fully understand the intention of Question 1-1. In case of MAC-CE, signalling details may need to involve RAN2. |
| MTK | We are fine to have triggering of temporary RS integrated with SCell activation/deactivation. However, if it requires two or more samples for UE to adjust an appropriate AGC gain and time/frequency tracking for the temporary RS (TRS), then we prefer to use another DCI(s) after the PCell interruption time due to the RF retuning of the activated SCell to provide consecutive triggering of temporary RS (TRS). |
| Nokia, NSB | We support Opt1.1a “MAC CE (triggering for both SCell activation and temporary RS)”  In case DCI is chosen, **Opt 1.2a** should be supported. |
| vivo | Yes, if the question is whether opt 1.1a or 1.2a should be considered then others.  It can simplify the design as TRS triggering and the SCell activation command are always received successfully at the same time. |
| Futurewei | We are fine with Opt 1.1a and Opt 1.2a.  For Opt 1.1a, we think there could also be two possibilities:  Opt 1.1a.1: the temporary RS trigger is implicit, such as a pre-configured temporary RS is automatically triggered with the MAC CE without any new field in the MAC CE.  Opt 1.1a.2: the temporary RS trigger is an explicit field added to the MAC CE. |
| ZTE | We are supportive to combine the SCell activation command and temporary RS activation/triggering command. |
| DOCOMO | Yes, the triggering of temporary RS and SCell activation should be indicated jointly. |
| Samsung | We support Opt 1.2a. Yes, the triggering of temporary RS should be integrated with SCell activation/deactivation trigger since it can achieve more delay reduction. |
| Ericsson | We think Option 1.1 + 1.2 should be starting point for discussion and advantages of other options should be compared to this. MAC CE related details should be handled together with RAN2. |
| CATT | We are OK with either Option 1.1a or Option 1.2a. |
| OPPO | We are fine with Opt 1.1a and Opt 1.2a |
| Intel | We support a joint triggering for SCell activation and temporary RS. Option 1.2a is first preference. |

**Question 1-2: Which triggering command for SCell activation/de-activation is preferable, i.e. whether MAC CE is sufficient or DCI-based triggering should be supported?**

Companies’ views are very welcome.

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| *Company* | *View* |
|  | Our view is more aligned with Opt.1.1a with an additional point.  Opt.1.1a should have less impact on RAN1 spec and RAN4 requirement with better signalling flexibility compared to the other options. The problem of Opt.1.1a is that the MAC-CE contents cannot be changed in case if the PDSCH carrying the MAC-CE is re-transmitted. That is, once the temporary RS trigger is indicated by a MAC-CE in a PDSCH, that trigger will be effective even when the PDSCH is re-transmitted. However, considering that SSB is also available on the SCell, the SCell is a TDD carrier, and/or various traffic is accommodated on the carrier, it is necessary to enable turn-off the RS trigger indication based on the network indication. We consider that the temporary RS should be triggered by the MAC-CE, but the DCI scheduling the PDSCH carrying the MAC-CE should be able to enable/disable the temporary RS. |
| MTK | We prefer DCI-based triggering since TRS is applied now and A-TRS is triggered by DCI in current spec. |
| Nokia, NSB | We support MAC CE for SCell activation/de-activation because of flexibility and functionality advantage of MAC CE over DCI. For example, MAC-CE unlike DCI is capable of indicating also TRS triggers for multiple activated Cells. We also don’t see a significant delay advantage of DCI over MAC-CE. |
| vivo | MAC CE is sufficient.  Opt 1.2a (DCI-based) significantly increases physical layer overhead if new DCI field(s) is introduced, or requires large design efforts if a new DCI format is introduced. Given that the existing MAC CE based SCell activation works well, the complicity of Opt 1.2a does not justify. |
| Futurewei | We are open to both. |
| ZTE | Regarding whether to adopt DCI based solution or MAC CE based solution, we prefer to have big picture of both the DCI based solution and MAC CE based solution first. Because different solutions may have different timeline, e.g., whether to support HARQ-ACK for DCI based solution. Besides, it is not clear what information needs to be carried in the triggering command, if the information bits carried by the command is large, then MAC CE based solution may be preferred, otherwise DCI based solution can also be considered.  With the understanding of different solutions, then RAN1 can compare the different solutions and pick the most efficient one. |
| DOCOMO | We support DCI-based triggering. |
| Samsung | We support DCI-based triggering. |
| Ericsson | We prefer to keep the existing MAC CE based approach for SCell activation/deactivation. |
| CATT | We are open to discuss both. |
| OPPO | Slightly prefer to DCI-based triggering and open to MAC CE based solution. |
| Intel | We slightly prefer DCI based triggering.  One question to MAC CE based method. Since the PDSCH carrying MAC CE for the trigger may be only received after one or more HARQ retransmission, shall gNB transmit temporary RS as if UE can always receive the MAC CE without retransmission or gNB only transmit temporary RS after reception of ACK for the MAC CE? The former option may waste temporary RS resource if there is retransmission. |

## Tactivation reduction

### Temporary-RS based

#### Issue-2: TRS structure for temporary RS

For the existing TRS structure, the time-domain locations are given in subclause 5.1.6.1.1 of TS 38.214

- , , or for frequency range 1 and frequency range 2,

- , , , , ,  or  for frequency range 2.

In the frequency domain, the number of TRS subcarrier within a RB is 3.

Companies’ views are summarized as follows:

* Opt 2.1: Reuse existing Rel-15/16 TRS structure refer to 5.1.6.1.1 of TS 38.214 [1][3][4][5][7][10][14]
* Opt 2.2: Flexible slot number configuration and no restriction of being bounded with P-TRS [6]

**Question 2: whether the Rel-15/16 TRS structure can be fully reused for temporary RS? If not, any reasons for what modification?**

Companies’ views are very welcome, especially on the proposal by Opt 2.2

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| *Company* | *View* |
| Qualcomm | In order to answer the question, we need to get some feedback from RAN4. |
| MTK | We think the answer is yes. If it requires two or more samples for UE to adjust an appropriate AGC gain and time/frequency tracking for the temporary RS (TRS), then another DCI(s) after the PCell interruption time can be used to provide consecutive triggering of temporary RS (TRS). |
| Nokia, NSB | We support Opt 2.1 i.e. to reuse the existing TRS structure (refer to 5.1.6.1.1 of TS 38.214). Since aperiodicTriggeringOffset already now allows flexible offset, hence we are confused about the first part of Opt2.2. |
| vivo | Depending on what the “reuse” means.  The Rel-15/16 structure is enough if the temporary RS is only for a single purpose (e.g., time/frequency tracking), but is not enough if a single TRS burst is used for both AGC settling and T/F tracking. |
| Futurewei | We may reuse the same structure, but during the activation process, the same TRS structure can be repeated multiple times based on the standard specification or RRC configuration.  Note that P-TRS can be sent after the A-TRS |
| ZTE | Currently, Rel-15/Rel-16 TRS structure has fixed time-domain locations and fixed time domain pattern. We may need to consult with RAN4 on this issue. And based on RAN4 feedback, RAN1 can further discuss whether to reuse Rel-15/Rel-16 TRS structure. |
| DOCOMO | We should discuss based on RAN4 feedback if any. If the existing Rel-15/16 TRS structure is reused, the repetition may need to be studied. |
| Samsung | We agree with that feedback from RAN4 is needed. Nevertheless, it would be good starting point for the discussion if RAN1 decide at least a high level principle for temporary RS design something like  - Reuse existing Rel-15/16 TRS structure if no issue is identified.  After decide it, we can include this information into the LS to be sent to RAN4. |
| Ericsson | We can assume existing Rel15/16 structure and check with RAN4 the SCell activation delay reduction possible with it. |
| CATT | We prefer to reuse the current TRS structure. |
| OPPO | We share the same view as QC.  And to be safe, flexible TRS slot number should be left now to support AGC setting and/or time/frequency tracking. Moreover, in different scenarios, the time to set AGC, i.e. required TRS slot numbers, maybe different.  In current spec, A-TRS should be bounded with P-TRS. However, for Scell activation, A-TRS is enough. So we suggest to decouple A-TRS with P-TRS. |
| Intel | We share same view that RAN4 feedback is important to decide on TRS pattern. |

#### Issue-3: QCL configuration of TRS

Aperiodic TRS can be QCLed with a periodic TRS and the periodic TRS can be QCLed with an SSB. Companies’ views are summarized as follows:

* **Opt 3.1:** Reuse the Rel-15/16 TCI framework for TRS [1][5][6]
* **Opt 3.2:** TRS for fast SCell activation should not require to be QCL-A with another periodic TRS on the same SCell [2]
* **Opt 3.3:** The aperiodic TRS will serve as QCL source for the subsequent CSI-RS and other DL RSs on the SCell [16]

**Question 3: whether the exiting Rel-15/16 TCI framework can be fully reused for temporary RS? If not, any reasons for what modification?**

Companies’ views are very welcome, especially on the proposals by Opt.2 and Opt.3.

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| *Company* | *View* |
| Qualcomm | TRS for fast SCell activation is not required to be QCLed with a P-TRS on the same SCell. However, the TRS would have to be QCLed with an SSB on the same SCell.  This ensures fallback operation of the SCell activation – the UE can use either the TRS or SSB for SCell activation as long as the delay requirement is met. |
| MTK | When the SCell activations begins, UE has lost the time/freq (QCL-A) and beam (QCL-D) tracking properties. Even if the temporary RS (A-TRS) is QCL-ed with P-TRS or SSB, UE may not have chance to measure the P-TRS or SSB. Therefore, we prefer Option 3 or 2. Option 1 is also acceptable to us if it is the majority view. |
| Nokia, NSB | We support Opt3.1 of reusing the Rel-15/16 TCI framework for TRS  At QC, isn’t P-TRS QCLed with SSB anyway indirectly? |
| vivo | Opt3.2  TRS for fast SCell activation should not require to be QCL-A with another periodic TRS on the same SCell. |
| Futurewei | we should not change the UE behavior once the SCell is activated. That is the UE always expects a P-TRS configured. In R15/16, it used to be that A-TRS is associated with a P-TRS. In the current case, the association should still be there but P-TRS (transmitted later) can obtain QCL from A-TRS instead. |
| ZTE | Based on the agreements reached in last RAN1 meeting, other reference signals are not precluded for temporary RS. It seems we even haven’t decided whether TRS is the only temporary RS yet. Then in this case, we are not sure Q3 here is only related to TRS.  If Q3 here refers to TRS only, we feel that the answer to this question may also be impacted by RAN4’s reply regarding whether the current TRS structure can be fully reused for SCell activation or not. Before RAN4’s reply, we can take Option 3.1 as the baseline for now. |
| DOCOMO | During SCell activation procedure, the restriction that TRS for fast SCell activation is QCLed with another P-TRS is not needed. |
| Samsung | We support Opt 3.1 as the baseline. We can revisit this issue after get more information from RAN4. |
| Ericsson | Option 3.3 or a similar formulation. Basically, to achieve latency reduction, the UE should be able to use the A-TRS to receive subsequent CSI-RS, PDCCH etc., without having to wait for a P-TRS or SSB. |
| CATT | We slightly prefer Option 3-1. We are also open to discuss whether there are any issues if follow the existing TCI framework. |
| OPPO | We prefer to option 3-3. And We share the view as Ericsson. |
| Intel | We slightly prefer Option 3-1. We share the view from Futurewei that A-TRS is QCLed with a P-TRS, so that P-TRS can get QCL assumption from the A-TRS after SCell activation. |

#### Issue-4: Time-domain property of TRS

In current specifications, both periodic and aperiodic TRS are supported, which TRS should be selected for temporary RS? Companies’ views on it are summarized as follows:

* **Opt 4.1** Aperiodic TRS [2][3][5][6][7][10][11][12][15][16][17]
* **Opt 4.2** Periodic RS [7][10][16]
* **Opt 4.3** Semi-persistent TRS [2][10]

**Question 4: Which TRS above should be selected as the temporary RS? Your views on benefit/gain, specification impact, implementation complexity are encouraged.**

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | Opt.4.1. |
| MTK | To our understanding the term “temporary” indicates it is a short term signal. Hence, we prefer Option 1. |
| Nokia, NSB | We support Opt 4.1 of Aperiodic TRS. |
| vivo | Opt 4.1.  If periodic TRS is used as the temporary RS, the delay of SCell activation could be reduced only when the periodicity of the TRS is small, i.e., 10ms, or an even smaller number is desirable for fast activation. However, this will cause significant network overhead. |
| Futurewei | This also depends on the outcome from previous questions. A-TRS has to be sent during the activation. After activation, the UE should expect/be configured with P-TRS as in R15/16 which is associated with the A-TRS. Therefore, we suggest to associate the TRSs before and after the activation, and endorse P/SP-TRS. |
| ZTE | We feel the answer to this question is highly depending on the RAN4’s reply. Our understanding is as below.  *Send LS to RAN4 to check whether the current two TRS patterns (i.e., 1-slot with two TRSs resources and 2-slot with four TRSs resources) are sufficient for AGC settling and time/frequency tracking during SCell activation.*  *- If Yes, then A-TRS is adopted as the temporary RS.*  *- If Not, then P-TRS/SP-TRS is adopted as the temporary RS.* |
| DOCOMO | Opt 4.1. |
| Samsung | Opt 4.1 |
| Ericsson | Opt 4.1 |
| CATT | Option 4-1 |
| OPPO | Option 4.1. TRS slot number is FFS, waiting for RAN4 reply. |
| Intel | Opt 4.1 |

#### Issue-5: Additional functionality of temporary RS during the SCell activation

To reduce the SCell activation latency, it is more important to reduce the delay for CSI measurement/reporting as much as possible. If the legacy RSs (e.g. SSB, P-CSI, SP-CSI) are still used for CSI measurement/reporting, the UE needs to wait for a long time. It is proposed to support CSI measurement/acquisition based on temporary RS.

Companies’ views on it are summarized as follows:

* Opt 5.1: Support [3][5]
* Opt 5.2: Not support

**Question 5: Whether the temporary RS should provide the functionality of CSI measurement/acquisition during the SCell activation?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | The temporary RS for AGC setting and for time/frequency tracking cannot be used for CSI measurement. The proponent should clarify the overall design. We do not need to preclude the possibility but designing temporary RS for AGC and time/frequency tracking should be prioritized. |
| MTK | Our preference is no. Since TRS is selected as temporary RS for known cell, it is not clear how to perform CSI measurement/report based on TRS. |
| Nokia, NSB | We support Opt 5.2, CSI measurement based on single port RS may not accurately represent the PDSCH transmission parameters e.g. number of ANT ports used. |
| vivo | The temporary RS used for AGC settling or T/F tracking can hardly be reused for CSI measurement. |
| Futurewei | We do not support using TRS for CSI, but a CSI-RS/SRS may also be sent as part of temporary RS. The CSI-RS/SRS can be used for CSI.  This discussion depends on the outcome of temporary RS decision. |
| ZTE | Currently, RAN1 has only decided to introduce TRS for AGC setting and T/F tracking during SCell activation. From our perspective, TRS is one specific CSI-RS. More specifically, TRS is a single port CSI-RS with density p=3 and TRS has its own specific time-domain pattern. From this perspective, TRS could also be used for channel measurement. However, RAN1 may need to address at least the following issues to allow UE to perform CSI measurement/acquisition based on TRS.  1) Currently, TRS is not allowed for CSI report;  2) Only single port TRS is allowed;  3) Aperiodic TRS must be associated with periodic TRS.  Another way is to introduce CSI-RS as temporary RS for SCell activation. All the current CSI-RS measurement and reporting mechanism can be fully reused. The only thing we may need to address is whether to enhance the CSI report triggering command.  Based on the above, we propose the following.  ***Proposal****: FFS whether to adopt TRS or CSI-RS for channel measurement/acquisition during SCell activation.* |
| DOCOMO | The functionality of CSI measurement/acquisition should not be precluded for now, but further study is needed. |
| Samsung | We support to have the functionality of CSI measurement/acquisition since it could be beneficial to further reduce the SCell activation latency. We agree with that the current specification does not support CSI measurement/reporting using TRS. We can further discuss how to realize the functionalities if agreed to support. |
| Ericsson | Opt 5.2 |
| CATT | Option 5-2. TRS is designed for obtaining accurate time/frequency synchronization information and the channel measurement is surely beyond its capability. |
| OPPO | TRS is a single port RS, it is hardly used for CSI. |
| Intel | To enable fast and efficient DL data transmission, an accurate CSI report is important. Therefore, we think the design of temporary RS should support CSI measurement. Details can be FFS. |

#### Issue-6: Timeline for temporary RS

During RAN1#102e meeting, based on the agreements, it was agreed that the triggered temporary RS is no earlier than a slot m. Companies’ views on it are summarized as follows:

* **Opt 6.1**

*“The duration between SCell activation command and reference signal for AGC settling and time/frequency tracking should be sufficient for L1/L2 signaling processing, RF warm-up and BWP activation. The reference signal for channel measurement is transmitted later than the reference signal for AGC settling and time/frequency tracking.”*[10]

* **Opt 6.2**

*“The actual slot for the triggered TRS can be r slot after the slot the UE sends HARQ-ACK for the PDSCH convering TRS triggering MAC CE, where the r can be configured by RRC, or more flexibly, indicated by the MAC CE. More specifically, when a UE receives the TRS triggering MAC CE in slot n, the UE processes the TRS burst starting in n + k + r + 0.5ms, where k is the slot UE sents HARQ-ACK for the PDSCH convering TRS triggering MAC CE, r is configured by RRC or indicated by MAC CE, and 0.5ms is the MAC-to-PHY processing delay. Noted that the indicated triggering offset should not smaller than the beam switching timing.*” [2]

* **Opt 6.3**

*“If MAC-CE is used as triggering command, the point after THARQ (timing between PDSCH and its HARQ-ACK) can be set to the earliest temporary RS transmission occasion. If DCI format is used as triggering command, the point after its HARQ-ACK can be set to the earliest scheduling occasion. So one offset can be enough for temporary RS, which starting point is the HARQ-ACK feedback slot of triggering command. This offset information can be included in temporary RS configurations.*”[4]

* **Opt 6.4** Details of timeline for fast SCell activation are decided in RAN4. [5]
* **Opt 6.5** Reuse the Rel-15/16 aperiodic triggering framework for temporary RS. [5]
* **Opt 6.6**

“*even when aperiodic TRS is not triggered, if a periodic TRS occurs before the first SSB after activation, then the activation delay should be based the delay between slot n+k1+3 and the slot where first periodic TRS is received, instead of delay between n+k1+3 and the slot with first SSB as currently specified in 38.133.*” [16]

**Question 6: which measurement timeline of temporary RS should be supported?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Qualcomm | This highly depends on the triggering signalling design and expected UE processes after the trigger is received. Further discussion is necessary. |
| MTK | We prefer Option 6.5 and 6.4. The appearance of the first slot in the aperiodic TRS as temporary RS needs to be after RF retuning (warmup) of the activated SCell. RAN1 to check with RAN4 whether the maximum value of 24 (slots) for the IE *aperiodicTriggeringOffset* is large enough. |
| Nokia, NSB | We support Opt 6.2 which offers the flexibility to configure the triggering delay ‘r’ in RRC. The reference for ‘r’ should be the first slot boundary after n+k+[d *ms*]. Where [d *ms*] may include in addition to the L1/L2 processing delay, also RF warm up and BB activation delay. |
| Vivo | Opt 6.2  But this question depends on whether DCI based or MAC CE based triggering mechanism is used. |
| Futurewei | We suggest to first agree on “starting slot” or “reference slot” for the start of trigger offset, and the “starting slot” or “reference slot” definition can be FFS. |
| ZTE | This discussion is highly depending on the triggering command and temporary RS structure. We may need to come back to this issue once RAN1 has clear understanding on these two aspects. |
| DOCOMO | The current options are based on some detailed design, e.g., MAC CE activation command, and it should be discussed after the decision of triggering command or more general options should be considered. |
| Samsung | We should prioritize and finalize other issues before discuss this issue. |
| Ericsson | If SCell activation is received in slot n, It should be possible to trigger the A-TRS such that it can occur as soon as possible after slot *n+k1+3*. |
| CATT | Our preference is option 6.5. The triggering offset of A-TRS can be configured in Rel-15/16 framework and can be up to 24 slots, we think it is sufficient to be reused here. |
| OPPO | Prefer to option 6.4 and 6.5. The triggering offset configuration of A-TRS should ensure enough processing time for UE. |
| Intel | Our understanding is aligned with Opt 6.2. For both MAC CE based or DCI based triggering, slot n can be the slot where UE transmits HARQ-ACK. |

#### Issue-7 [2nd CP]: Associated BWP for temporary RS

All the BWP configured on an 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 7.1** The BWP configured by “*firstActiveDownlinkBWP-Id”*[2][6][14]
* **Opt 7.2** gNB indicates the BWP along with the indication of triggering the temporary RS [3][15]

**Question 7: 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.7.1. |
| MTK | We prefer Option 1 (it seems intuitive to activate an SCell using the firstActiveDownlinkBWP). |
| Nokia, NSB | We support Opt7.1 but it is not fully clear to us if there is any association between the TRS resource and the BWP since TRS resource is configured in the serving cell config. gNB needs to guarantee that the 52 RBs are present within the first active downlink BWP. |
| vivo | Opt 7.1 |
| Futurewei | We can support both. If there is no explicit indication of BWP or temporary RS associated with a different BWP, then we can use firstActiveDownlinkBWP, otherwise the indicated one is used. |
| ZTE | We see that this issue is highly depending on the triggering command. If DCI based solution is adopted, Opt 7.1 may be preferred as it may be difficult to indicate the target BWP. However, if MAC CE based solution is adopted, Opt 7.2 is preferred since BWP ID can be explicitly indicated in the MAC CE.  Thus, we propose to come back to this issue once triggering command is finalized. |
| DOCOMO | We support Opt 7.2, and if there is no indication of the BWP, firstActiveDownlinkBWP can be used. |
| Samsung | Opt 7.1 |
| Ericsson | Prefer to come back to this issue once triggering command is finalized. |
| CATT | Option 7.2. We don’t see the necessity to restrict that only the TRS on the firstActiveDownlinkBWP can be used for Scell activation purpose. |
| OPPO | Option 7.1 |
| Intel | Opt 7.1. Especially when CSI measurement is also supported by temporary RS, the temporary should be on the frequency range of firstActiveDownlinkBWP so that the measured CSI is valid |

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

#### Issue-8 [2nd CP]: Tactivation reduction with BS assistance but no temporary RS nor SSB

It is proposed in [1][7][15] that activation time of the To-be-activated cell can be reduced by acquiring activation information (e.g. synchronization and AGC-related 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 to assist the activation of the To-be-activated cell, which may speed up the procedure of synchronization and AGC.

**Question 8: Whether it is beneficial for Tactivation reduction that BS assistance information or common property (e.g. frequency/timing synchronization, path loss, coupling loss, RSRP) derived from activated cell?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | This depends on various conditions, e.g., intra-band vs inter-band, FR1 vs FR2, known cell vs unknown cell, etc.  According to TS38.133, RAN4 has already specified similar concept; for a known cell in FR2 intra-band CA, SCell activation relies on the SSB on already active serving cell in the same band if there is any. Proponents should clarify what is envisioned on top of that. |
| MTK | We think it is only beneficial if the activated cell is in the same band with the To-be-activated cell. |
| Nokia, NSB | This item should be discussed after high priority items are resolved. |
| Vivo | It may be beneficial for some cases. But we should first focus on the design of TRS based temporary RS. |
| Futurewei | We think what Qualcomm pointed out can be generalized to FR1 and captured in RAN1 specs if needed. In addition, even for inter-band CA where the bands are not far from each other, initial tracking/PL/RSRP may be similar and can be used for another carrier (possibly with an offset). |
| ZTE | The question is too general here from our perspective. We prefer to determine the clear target use cases and scenarios first and then we can come back to discuss whether it is beneficial or not. |
| DOCOMO | We think it is beneficial at least for intra-band CA case including FR1. Gnb can indicate e.g., such combination of cells or an offset of the property. The exact condition may need further study/discussion. |
| Samsung | This issue should be discussed after other issues are resolved. |
| Ericsson | Focus should be on reduction of activation delay from the values specified in RAN4. |
| OPPO | This issue should be discussed after other issues are resolved. |
| Intel | The proposal is something nice to have. However it is not universally applicable. Therefore, we think the basic design on temporary RS based scheme should be prioritized. |

## TCSI\_reporting reduction

### Issue-9 [2nd CP]: Enhancement for CSI reporting

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

* **Opt 9.1** for acquisition of CSI after activation, reuse the existing R15/R16 framework. [14]
* **Opt 9.2** short interval P/SP- CSI-RS report [7]

“*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.*”[7]

* **Opt 9.3** remove TCSI\_reporting for the case of FR2 unknown cell[7]

“*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.*”[7]

**Question 9: which option above of CSI reporting enhancement should be supported?**

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | Opt.9.1. |
| MTK | We slightly prefer Option 1 since TCSI\_reporting does not seem to be the dominant term compared to *Tactivation\_time*. |
| Nokia, NSB | This item should be discussed after high priority items are resolved. |
| vivo | Opt 9.1 |
| Futurewei | We are open to discuss all the three options, as they do have some merit in different scenarios.  Also if what the network needs for initial CSI can be acquired in SRS, CSI reporting is not necessary. |
| ZTE | It seems we can reuse the Rel-15/Rel-16 framework for CSI reporting. We didn’t see any issue with the current reporting framework. |
| DOCOMO | Opt 9.1. |
| Samsung | This issue should be discussed after other issues are resolved. |
| Ericsson | Opt 9.1 |
| CATT | Option 9.1 |
| OPPO | Option 9.1 |
| Intel | A solution to enable fast CSI report should be available. Details can be discussed after other high prioritized issues being resolved. |

## General Issues

This section discusses the general issues for SCell activation/deactivation. As discussed in section 2, the issues with “2nd CP” are planned to be concluded by the second check point (Nov. 10th).

* **Question G1 [2nd CP]:** Whether or not should temporary RS be introduced for unknown cells? [6][12][15]

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | At the last RAN1 meeting we agreed to prioritize known cell. We can come back to this question once the design for known cell is clearer. |
| MTK | For unknown cell, transmitting temporary RS for FR2 can be resource consuming since NW needs to provide enough RS samples for UE to perform Rx beam tracking.  For unknown cell in FR1, introducing temporary RS can significantly reduce the SCell activation time while the required resource is evidently smaller than FR2 since there is no need to perform Rx beam tracking.  Hence, we suggest to introduce temporary RS for unknown cell in FR1. |
| Nokia, NSB | This item should be discussed after MAC CE vs DCI question is resolved. |
| vivo | At least is beneficial for AGC settling and/or T/F tracking. |
| Futurewei | If we agree that RS based on SSB can be temporary RS, then it is used to introduce it for unknown cells. |
| ZTE | This issue may also need RAN4 involvement. Different requirements are specified for known and unknown cells in RAN4, it would be better to check with RAN4 first. |
| DOCOMO | Temporary RS can provide at least the functionalities of AGC setting and time/frequency tracking, and SCell activation delay can be reduced well even for the case of unknown cell. We support to introduce temporary RS for unknown cell. |
| Samsung | We prefer to prioritize known cell case. |
| CATT | Similar views as above companies. This issue deserves a lower priority than known cell. |
| OPPO | Yes. It is beneficial for AGC setting and/or time/frequency tracking at least. Unified procedure is applied for known and unknown cell cases. |
| Intel | We prefer to prioritize known cell case. |

* **Question G2 [2nd CP]:** Whether the accurate timing for SCell activation should be clarified or not [4], i.e. after which time points of time point#1, #2 and #3 in the Figure 1 of [3] is the to-be-activated SCell regarded as activated?

Companies’ views are very welcome.

|  |  |
| --- | --- |
| *Company* | *View* |
| Qualcomm | Not sure how this clarification impacts on the RAN1 spec design. |
| MTK | To us it is clearly point #3. We are open for further clarification. |
| Nokia, NSB | This item should be discussed after high priority items are resolved. |
| vivo | It seems to be a RAN4 topic. |
| Futurewei | Point #3 in general, and this point may also be the time point that the UE sends a SRS, which may be faster than a CSI feedback. |
| ZTE | We have discussed this issue in previous meeting. It is not clear why we need to change the current definition. |
| Samsung | This issue should be discussed after other issues are resolved. |
| CATT | It was discussed in the last meeting without consensus, i.e. different companies have different understanding in mind.  The impact on RAN1 spec would be: it determines whether the current mechanism can be fully reused or not. Some detail examples are shown below:  If point#1 is regarded as the activation, gNB can trigger an A-TRS/A-CSI-RS with a DCI for the Scell and we don’t need to consider the new temporary RS.  If point#2 or point#3 is regarded as the activation time, in order to reduce the T\_activation and T\_CSI\_reporting, new temporary RS and the corresponding triggering mechanism are necessary because A-TRS/A-CSI-RS cannot be triggered for the SCell in the current specification. |
| OPPO | Not necessary or low priority. |
| Intel | We are open for clarification |
|  |  |

* **Question G3 [2nd CP]:** 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. [1]

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| Qualcomm | As agreed in the last meeting, we do not need to preclude them at this stage. |
| MTK | We suggest to introduce temporary RS for unknown cell in FR1 using one of AP CSI-RS, P/SP CSI-RS, SRS, and RS based on SSS/PSS as temporary RS. |
| Nokia, NSB | We could consider SSS/PSS as temporary RS. |
| vivo | We should first focus on the design of TRS based temporary RS. |
| Futurewei | Agree to support them depending on network configuration and UE capability. |
| ZTE | We may need to first clarify the intended function of these additional temporary RS. If the function is justified, then we can discuss whether to introduce it or not.  Besides, questions for clarification, we are not sure the definition of temporary RS. In particular, if we follow the current mechanism to trigger UE to measure CSI-RS and report CSI during SCell activation, is the CSI-RS here regarded as temporary RS? |
| DOCOMO | It should not be precluded for now. |
| CATT | We are open to discuss. |
| OPPO | SSS/PSS should be considered, it is an original solution. No reason to preclude it. |
| Intel | Temporary RS design should allow fast CSI measurement. In general, one question is that is temporary RS a single kind of RS or can be a combination of multiple kinds of RSs. |

**Question G4 [2nd CP]:** Whether or not RAN1 confirms the benefit of supporting periodic SRS on dormant BWP in Rel.17 and inform of it to RAN2. [17]

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| Qualcomm | Yes. |
| MTK | Yes. SRS is very useful especially for TDD scenario. With periodic SRS on dormant BWP, UE does not have to wake up frequently to monitor channel quality. |
| Nokia, NSB | Dormancy is out of scope of this work item in our opinion. This can be considered later in Rel-17 in this AI once the SCell activation design is finalized. |
| vivo | It should be decided in RAN. |
| Futurewei | Yes |
| ZTE | Yes. SRS is useful regarding UL beam tracking, TA maintenance and channel update, etc. |
| Samsung | No |
| OPPO | Share the view with Nokia, NSB |
| Intel | Out-of-scope? |

**Question G5 [2nd CP]:** Whether The TRS for fast SCell activation consists of one TRS burst for AGC settling and another TRS burst for time/frequency tracking. [2]

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| Qualcomm | This is related to our suggestion on sending LS to RAN4. |
| MTK | Yes. To our understanding this is common for SCell activation. We can check with RAN4 if necessary. |
| Nokia, NSB | This item should be prioritized since it is a critical aspect of the design and RAN4 input maybe needed. |
| vivo | We think this is one simple solution that reuses the R15/R16 structure as much as possible. |
| Futurewei | Yes |
| ZTE | We may need to check with RAN4. |
| DOCOMO | RAN4 feedback seems necessary. |
| Samsung | We can check with RAN4. |
| CATT | Yes. |
| OPPO | Check with RAN4. |
| Intel | We can check with RAN4. |

**Question G6 [2nd CP]:** Whether an LS to RAN4 is needed now, e.g. requesting performance requirements for TRS [10]

Companies’ views are very welcome.

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| --- | --- |
| *Company* | *View* |
| Qualcomm | Yes. |
| MTK | We think *2-slot with four TRSs resources* (4 samples) should be enough, but can still check with RAN4. |
| Nokia, NSB | We agree an LS to RAN4 to request whether fast Scell activation is feasible based on Rel-16 Aperiodic TRS and what would be the activation delay requirement needed. |
| vivo | The motivation of this LS is not very clear currently. We should focus on the design of TRS. Once specific issues are identified, an LS is then needed. |
| Futurewei | Same view as MTK. |
| ZTE | Yes. As commented in the above questions, lots of questions may need to be checked with RAN4 first. |
| DOCOMO | Yes |
| Samsung | Yes |
| CATT | Yes |
| OPPO | Yes |
| Intel | Yes |

## Other Issues

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

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

# References

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# Appendix: Agreements

|  |
| --- |
| **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 |