**GPP 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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# 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]
* **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][17]

**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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**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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## 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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#### 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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#### 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]
* **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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#### 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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#### 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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#### 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.

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### 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.

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## 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.

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## 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.

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* **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.

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* **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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**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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**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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**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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## Other Issues

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

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# Conclusions

# References

1. [R1-2007548](file:///C:\\Users\\wanshic\\OneDrive%20-%20Qualcomm\\Documents\\Standards\\3GPP%20Standards\\Meeting%20Documents\\TSGR1_103\\Docs\\R1-2007548.zip) Support efficient activation/de-activation mechanism for Scells FUTUREWEI
2. [R1-2007697](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007697.zip) Discussion on efficient activation/de-activation mechanism for Scells vivo
3. [R1-2007841](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007841.zip) Disucssion on efficient activation/de-activation mechanism for Scell in NR CA CATT
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5. [R1-2008197](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008197.zip) On efficient activation/de-activation mechanism for Scells Samsung
6. [R1-2008286](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008286.zip) Discussion on efficient activation/de-activation for Scell OPPO
7. [R1-2008322](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008322.zip) Discussion on efficient activation/de-activation mechanism for SCells Huawei, HiSilicon
8. [R1-2008453](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008453.zip) On efficient SCell Activation/Deactivation Apple
9. [R1-2008713](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008713.zip) Efficient activation/deactivation of SCell ASUSTeK
10. [R1-2008832](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008832.zip) Discussion on Support Efficient Activation De-activation Mechanism for SCells in NR CA ZTE
11. [R1-2008849](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008849.zip) Discussion on efficient activation mechanism for SCells NEC
12. [R1-2008968](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008968.zip) On supporting efficient activation mechanism for SCells in NR CA MediaTek Inc.
13. [R1-2009005](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2009005.zip) On efficient activation/de-activation for SCells Intel Corporation
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16. [R1-2009208](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2009208.zip) Reduced Latency SCell Activation Ericsson
17. [R1-2009279](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2009279.zip) Views on efficient activation/de-activation mechanism for SCells in NR CA Qualcomm Incorporated

# Appendix: Agreements

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| **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 |