**3GPP TSG RAN WG1 #102-e R1-200xxxx**

**E-Meeting, August 17th – 28th, 2020**

**Agenda Item: 8.13.3**

**Source: Moderator (Huawei)**

**Title: Summary of discussions on** **efficient activation/de-activation mechanism for SCells in 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 Wednesday August 19th.

[102-e-NR-DSS-DC\_enh2-01] Email discussion/approval using the summary as a starting point, focusing on high-level aspects – Ravi (Ericsson) & Frank (Huawei)

* By 8/19 – Classification of high priority/medium priority items for this e-Meeting
* By 8/24 – high priority items
* By 8/27 - medium priority items

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 RAN1 task by WID RP-201040, all identified issues are summarized and listed in Section 3 to facilitate discussions. In section 2, discussion priority for those issues is addressed.

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| The objective of this work item is to specify enhancements to MR-DC related scenarios. At least the following topics should be considered in the work:1. Support efficient activation/de-activation mechanism for one SCG and SCells
* Support for one SCG applies to (NG)EN-DC, and NR-DC [RAN2, RAN3, RAN4]
* Support for SCells applies to NR CA, based on RAN1 leading mechanisms [RAN1, RAN2, RAN4]
* This objective applies to FR1 and FR2
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# Summary of issues and priorities

According to all of companies’ contribution documents, all the issues includes six specific issues and nine general issues are summarized below, with more details in Section 3. As per chairman’s guidance, the priority of issues will be discussed first, and then focus on the high priority/medium priority items for this e-Meeting. Please companies provide your views at least for this section by 18:00 PST Tuesday, August 18 (UTC 01:00, August 19).

For the specific issues to activation/deactivation process:

* **Issue-1:** Triggering command for SCell activation/de-activation
* **Issue-2:** The functionality of temporary RS during the SCell activation
* **Issue-3:** Candidate RS for the temporary RS
* **Issue-4:** Triggering command for temporary RS
* **Issue-5:** Tactivation reduction with BS assistance but no temporary RS nor SSB
* **Issue-6**: Enhancement for CSI reporting

Please feedback either “No need”, “Low”, “Medium” or “High” as priority for the following issues. Your simple justification for it is welcome with details left to Section 3.

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| *Company* | *Issue-1* | *Issue-2* | *Issue-3* | *Issue-4* | *Issue-5* | *Issue-6* |
| Futurewei | Medium | High  | Medium  | High  | High  | Medium  |
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For general issues, they are translated as ‘Yes/NO’ questions for your convenience, which each is basically extracted from a proposal of one company:

* **Question G1:** Whether or not should RAN1 consider at least the cases of FR1 unknown cell and FR2 unknown cell, if RAN1 decides to design temporary RS to assist fast SCell activation? [3]
* **Question G2:** Whether or not can UE measure the triggered RS on the BWP indicated by “firstActiveDownlinkBWP-Id” although the BWP is inactive during Scell activation procedure? [1]
* **Question G3:** 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 [4] is the to-be-activated SCell regarded as activated?
* **Question G4:** Whether or not RAN1 starts the corresponding work only after RAN4 firstly estimate to what extent the delay for activation/deactivation could be reduced and potential improvement, e.g. extra information/assumption, required to reduce the delay?[12]
* **Question G5:** Whether or not in this WI RAN1 to identify and resolve any issue related to simultaneous operation of SCell dormancy and secondary DRX group? [9]
* **Question G6:** Whether or not in this WI RAN1 to consider extending the SCell dormancy mechanism to more efficiently support the SCG dormancy?[9]
* **Question G7:** Whether RAN1 should not work on an enhancement for SCell activation/de-activation for NR-CA with putting aside SCell dormancy? [13]
* **Question G8:** For SCell dormancy, whether is it unnecessary or not to re-open the discussions for the features that were not supported in Rel.16, unless other factors (e.g., SCG suspension) are to be taken into account? [13]
* **Question G9:** Whether or not RAN1 need to further study scenarios, if any, in which gNB knowledge of TCI-state or SSB index for a Scell activation may not be clear enough, such as inter-band CA? [5]

Please feedback either “No need”, “Low”, “Medium” or “High” as priority for the following questions. Your simple justification for it is welcome with details left to Section 3.

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| *Company* | *Question G1* | *Question G2* | *Question G3* | *Question G4* | *Question G5* | *Question G6* | *Question G7* | *Question G8* | *Question G9* |
| Futurewei | No need | Yes | High | No need | No need | No need | High | No need | Medium |
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# Discussions

In current specifications, when a UE receives a SCell activation command in a PDSCH in slot $n$, the UE shall complete SCell activation no earlier than $n+k$ and no later than slot *n*+ [*THARQ* + *Tactivation\_time* + *TCSI\_Reporting*]/$T\_{slotlength}$ as shown in Figure 1. Therefore, reducing *THARQ*, *Tactivation\_time* and *TCSI\_Reporting* is the key to achieve efficient SCell activation/de-activation mechanism. Companies’ views are summarized in the sections below. In addition to your feedback to Section 2, more detailed comments are welcome.



Figure 1 SCell activation procedure

## THARQ reduction

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

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

* Opt 1.1 reusing current MAC CE(only for SCell activation) [12]
* Opt 1.1a MAC CE (triggering for both SCell activation and temporary RS) [2]
* Opt 1.2 DCI (triggering only for SCell activation) [11][12]
* Opt 1.2a DCI (both for SCell activation and temporary RS) [2]

**Question 1: Which triggering command for SCell activation/de-activation is preferable, i.e. whether MAC CE is sufficient or DCI-based triggering should be supported in this WI? Whether the triggering of temporary RS, if introduced, is integrated with SCell activation/deactivation trigger?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | 1.2a (the DCI may be the trigger of the temporary RS, which also serves as the SCell activation command; see [15]); 1.1a |
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## Tactivation reduction

### Temporary RS based

#### Issue-2: The functionality of temporary RS during the SCell activation

In current specifications, SSB is used for cell search, AGC settling and time/frequency tracking, CSI-RS is used for CSI reporting during SCell activation procedure. If temporary RS is introduced, it is interest to determine which functionality should be provided by temporary RS in order to reduce activation delay. Companies’ views on it are summarized as follows:

* Opt2.1 AGC settling[1][2][3][6][10][14]
* Opt2.2 Time/frequency tracking[1][2][4][5][6][10][14]
* Opt2.3 CSI measurement[4][6]
* Opt2.4 Cell search[3]

“*For the SCell activation time of FR1/FR2 unknown cell, the dominant term comes from the operation of AGC gain setting (part D in Figure 1 and 3) and cell search (part E in Figure 1 and 3)*”[3].

**Question 2-1: Whether should a temporary RS be supported for Tactivation reduction?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | Yes |
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**Question 2-2: Which functionality above should be provided by temporary RS during the SCell activation?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | 2.1, 2.2, 2.3. In addition, if A-SRS is triggered as a temporary RS, the A-SRS can provide functionalities such as UL TA acquisition, UL/DL CSI acquisition, etc. |
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#### Issue-3: Candidate RS for the temporary RS

If temporary RS is introduced, the RS candidates can be Rel15/16 RS, e.g. A-TRS, SP CSI-RS, aperiodic CSI-RS, SP TRS, etc. Companies’ views are summarized as follows:

* Opt 3.1 TRS [2]
	+ Opt 3.1.1 aperiodic TRS [1][5][10]
* Opt 3.2 aperiodic CSI RS [7]
* Opt 3.3 short interval P/SP-CSI RS [6][8][14]

**Question 3: Which RS above should be selected as the temporary RS to provide the functionalities in question 2-2? Your views on benefit/gain, specification impact, implementation complexity are encouraged.**

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | 3.3, 3.2, 3.1.1, and possibly A-SRS |
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#### Issue-4: Triggering command for temporary RS

If temporary RS is introduced, the triggering command for the temporary RS should be discussed. Companies’ views with respect to different types of proposed temporary RS are summarized as follows:

* Opt4.1 A-CSI-RS
	+ Opt4.1.1 DCI [7]
* Opt4.2 A-TRS
	+ Opt4.2.1 new MAC CE [1][5]
	+ Opt4.2.2 DCI[4]
* Opt4.3 TRS
	+ Opt4.3.1 MAC CE (both for temporary RS and SCell activation)[2]
	+ Opt4.3.2 DCI (both for temporary RS and SCell activation)[2]

**Question 4: Depending on the outcome of Q1 and Q3, but companies’ views on above options are welcome, especially which options have unique advantage in term of benefit/gain, specification impact, implementation complexity?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | DCI as triggering command. 4.3.2 for A-TRS, 4.3.1 for A-TRS, or A-SRS DCI for A-SRS triggering and SCell activation |
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### The To-be-activated cell acquires essential information for activation enhancement from active cell

#### Issue-5: Tactivation reduction with BS assistance but no temporary RS nor SSB

It is proposed in [14] 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 and even may be sharing the same BS hardware with it, e.g. the same RF module. 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 5: Whether is BS assistance information (e.g. information based on reference active cells) useful for Tactivation reduction?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | Yes. It is useful to specify network assistance signaling to the UE about the side information on the to-be-activated SCell to reduce the latency [15].  |
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## TCSI\_reporting reduction

### Issue-6: Enhancement for CSI reporting

How to reduce the TCSI\_reporting is also a key to achieve efficient SCell activation. Companies’ views are summarized as follows:

* Opt 6.1 reusing R15/R16 framework, including RS and CSI reporting mechanism [5]
* Opt 6.2 PUCCH-based reporting for A-CSI [7]

“*Enhancing the A-CSI measurement and reporting framework can enhance SCell activation by reducing a corresponding delay. To enable A-CSI measurement/reporting for a deactivated SCell, a triggering method using group-common DCI (i.e., non-scheduling DCI) can be considered. In NR Rel-16, an A-CSI report is conveyed by PUSCH and cannot be provided via PUCCH. For a deactivated SCell, it is not possible to report A-CSI by PUSCH. Therefore, PUCCH-based reporting for A-CSI should be supported.*”[7]

* Opt 6.3 short interval P/SP- CSI-RS report [8][14]

“*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.*”[8]

* Opt 6.4 remove TCSI\_reporting for the case of FR2 unknown cell[14]

“*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.*”[14]

* Opt 6.5 triggering UL SRS for CSI acquisition

**Question 6: which option above of CSI reporting enhancement should be supported?**

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | Opt 6.5 and 6.3 |
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## General Issues

This section discusses the general issues for SCell activation/deactivation.

* **Question G1:** Whether or not should RAN1 consider at least the cases of FR1 unknown cell and FR2 unknown cell, if RAN1 decides to design temporary RS to assist fast SCell activation? [3]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | No need to consider such a case since basically initial cell acquisition is needed for an unknown SCell, which would take a long time anyway. The exception may be when the “unknown” SCell shares some properties (e.g., timing) with another known SCell and the UE can still assume some knowledge about the “unknown” SCell. |
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* **Question G2:** Whether or not can UE measure the triggered RS on the BWP indicated by “firstActiveDownlinkBWP-Id” although the BWP is **inactive** during Scell activation procedure?[1]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | Yes. This helps reduce the latency. |
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* **Question G3:** 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 [4] is the to-be-activated SCell regarded as activated?

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | Yes. This is essential to ensure the companies having a common understanding of “activation”. A change from legacy definition of activation can be supported but need to be clarified. |
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* **Question G4:** Whether or not RAN1 starts the corresponding work only after RAN4 firstly estimate to what extent the delay for activation/deactivation could be reduced and potential improvement, e.g. extra information/assumption, required to reduce the delay? [12]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | RAN1 can start the work, and in the meantime RAN1 should send LS to RAN4. |
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* **Question G5:** Whether or not in this WI RAN1 to identify and resolve any issue related to simultaneous operation of SCell dormancy and secondary DRX group? [9]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | No need. They are for different times. |
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* **Question G6:** Whether or not in this WI RAN1 to consider extending the SCell dormancy mechanism to more efficiently support the SCG dormancy?[9]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | No need |
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* **Question G7:** Whether RAN1 should not work on an enhancement for SCell activation/de-activation for NR-CA with putting aside SCell dormancy? [13]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | RAN1 should work on enhancement for SCell activation/de-activation regardless, as NR SCell activation/de-activation is slower than LTE [15]. |
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* **Question G8:** For SCell dormancy, whether is it unnecessary or not to re-open the discussions for the features that were not supported in Rel.16, unless other factors (e.g., SCG suspension) are to be taken into account? [13]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | No need |
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* **Question G9:** Whether or not RAN1 need to further study scenarios, if any, in which gNB knowledge of TCI-state or SSB index for a Scell activation may not be clear enough, such as inter-band CA? [5]

Companies’ views are very welcome.

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| *Company* | *View* |
| Futurewei | This can potentially reduce latency. Some RAN4 inputs may be needed. |
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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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| *Company* | *View* |
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# Conclusions

[TBU]

For this RAN1 meeting, classification of high priority/medium priority items for this e-Meeting

* High priority:
	+ Issues: xx, xx,
* Medium priority:
	+ Issues: xx, xx,
* Low priority:
	+ Issues: xx, xx,

# References

1. R1-2005411 Discussion on efficient activation/de-activation mechanism for Scells vivo
2. [R1-2005442](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2005442.zip) Discussion on Support Efficient Activation De-activation Mechanism for SCells in NR CA ZTE
3. [R1-2005629](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2005629.zip) On supporting efficient activation mechanism for SCells in NR CA MediaTek Inc.
4. [R1-2005698](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2005698.zip) Disucssion on efficient activation/de-activation mechanism for Scell in NR CA CATT
5. [R1-2005908](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2005908.zip) On low latency Scell activation Nokia, Nokia Shanghai Bell
6. [R1-2006065](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006065.zip) Efficient activation/de-activation for Scell OPPO
7. [R1-2006178](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006178.zip) On efficient activation/de-activation mechanism for Scells Samsung
8. [R1-2006283](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006283.zip) Discussion on efficient activation/de-activation mechanism for SCells in NR CA Spreadtrum Communications
9. [R1-2006511](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006511.zip) Views on Rel-17 DSS SCells efficient activation/de-activation Apple
10. [R1-2006673](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006673.zip) Reduced Latency SCell Activation Ericsson
11. [R1-2006751](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006751.zip) Discussion on efficient activation/deactivation mechanism for SCells NTT DOCOMO, INC.
12. [R1-2006754](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006754.zip) Efficient activation/deactivation of SCell ASUSTEK COMPUTER (SHANGHAI)
13. [R1-2006835](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006835.zip) Views on efficient activation/de-activation mechanism for SCells in NR CA Qualcomm Incorporated
14. [R1-2006927](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006927.zip) Discussion on efficient activation/de-activation mechanism for SCells Huawei, HiSilicon
15. [R1-1912730](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_99/Docs/R1-1912730.zip) On efficient and low latency low power serving cell operations Futurewei