**3GPP TSG RAN WG1 #106-e R1-21xxxxx**

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

**Agenda Item: 7.1**

**Source: Moderator (ZTE)**

**Title: Summary for discussion [106-e-NR-7.1CRs-06] Issue#11: On the PDCCH monitoring behavior during SCell activation**

**Document for: Discussion and Decision**

# Introduction

This document is to kick-off the following email discussion:

[106-e-NR-7.1CRs-06] Issue#11: On the PDCCH monitoring behavior during SCell activation by August 20 – Ling (ZTE)

[R1-2107008](file:///C:\working_document\3GPP_5G_standadization\Rel-17%20NR-U\Meetings\RAN1%23106\Docs\R1-2107008.zip) On the PDCCH monitoring behavior during SCell activation ZTE, Sanechips [1]

# Background

In RAN1#104 e-meeting, RAN1 received an LS from RAN4 [2] to ask RAN1 to provide feedback on the UE behavior of P/SP CSI-RS measurement and report during SCell activation in the maintenance of Rel-16 NR-U. After the discussion at that meeting, RAN1 only answered the first question of RAN4 and has no consensus on other questions and sent a partial reply to RAN4 in [3], as copied below:

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| RAN1 discussed the questions about the UE behavior with respect to CSI reports during the SCell activation procedure in case none or some of RRC parameters CO-DurationPerCell-r16, SlotFormatIndicator, and CSI-RS-ValidationWith-DCI-r16 are configured with or without corresponding DCIs for the SCell being activated:  **Question by RAN4** (1)When none of the RRC parameters CO-DurationPerCell-r16, SlotFormatIndicator, and CSI-RS-ValidationWith-DCI-r16 is configured for a UE on the being-activated SCell,  a.      What is the expected UE behavior for this P/SP CSI-RS measurement and report on the being-activated SCell?  **Reply by RAN1:** As in Rel-15, the UE is expected to receive the P/SP CSI-RS.  **Question by RAN4** (2)When RRC parameters CSI-RS-ValidationWith-DCI-r16 is configured, but SlotFormatIndicator and CO-DurationPerCell-r16 are not configured for the being-activated SCell,   1. What is the expected UE behavior for this P/SP CSI-RS measurement and report on the being-activated SCell? Does UE need to decode a DCI format from other active serving cell (indicating an aperiodic CSI-RS reception or scheduling a PDSCH reception in the set of symbols of the slot) for this being-activated SCell to validate this P/SP CSI-RS?   **Question by RAN4** (3)When RRC parameters CO-DurationPerCell-r16 is configured but SlotFormatIndicator is not configured for the being-activated SCell,   1. What is the expected UE behavior for this P/SP CSI-RS measurement and report on the being-activated SCell? Does UE need to decode a DCI format 2\_0 (indicating remaining channel occupancy duration) from other active serving cell for this being-activated SCell to validate the CSI-RS?   **Question by RAN4** (4)When RRC parameters CO-DurationPerCell-r16 is not configured but SlotFormatIndicator is configured for the being-activated SCell,  a.      What is the expected UE behavior for this P/SP CSI-RS measurement and report on the being-activated SCell? Does UE need to detect a DCI format 2\_0 (indicating the starting point of CO duration and the slot format) from other active serving cell for this being-activated SCell to validate the CSI-RS?  **Reply by RAN1:** RAN1 has discussed these cases, but has not achieved consensus on the expected UE behaviour. RAN1 will inform RAN4 if consensus is achieved in the future. |

For the remaining questions 2/3/4, they have been discussed in the maintenance of NR-U in the RAN1 #104bis and #105 e-meeting, but no consensus has been achieved due to differing views on some fundamental aspects of UE behavior in terms of Rel-15 carrier aggregation implementations, i.e. PDCCH monitoring behavior during SCell activation. More specifically, the divergence is whether “the Section 11 UE-group common signalling” in TS 38.213 is also applicable to a being-activated SCell in additional to activated SCell.

Besides, there is no consensus in the maintenance of NR-U on how to interpret “not monitoring PDCCH for SCell ” in the section 5.9 of TS 38.321.

For the above mentioned two technical points, some discussions and potential alternatives are provided in [R1-2107008](file:///C:\working_document\3GPP_5G_standadization\Rel-17%20NR-U\Meetings\RAN1%23106\Docs\R1-2107008.zip), copied below:

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| [R1-2107008](file:///C:\working_document\3GPP_5G_standadization\Rel-17%20NR-U\Meetings\RAN1%23106\Docs\R1-2107008.zip)(ZTE, Sanechips)  The related specs in TS 38.321 [4] are copied below:  ----------------------------------Start -----------------------------------------------------  5.9 Activation/Deactivation of SCells  If the MAC entity is configured with one or more SCells, the network may activate and deactivate the configured SCells. Upon configuration of an SCell, the SCell is deactivated unless the parameter *sCellState* is set to *activated* for the SCell by upper layers.  ....  The MAC entity shall for each configured SCell:  1> if an SCell is configured with *sCellState* set to *activated* upon SCell configuration, or an SCell Activation/Deactivation MAC CE is received activating the SCell:  2> if the SCell was deactivated prior to receiving this SCell Activation/Deactivation MAC CE; or  2> if the SCell is configured with *sCellState* set to *activated* upon SCell configuration:  3> if *firstActiveDownlinkBWP-Id* is not set to dormant BWP:  4> activate the SCell according to the timing defined in TS 38.213 [6] for MAC CE activation and according to the timing defined in TS 38.133 [11] for direct SCell activation; i.e. apply normal SCell operation including:  5> SRS transmissions on the SCell;  5> CSI reporting for the SCell;  5> PDCCH monitoring on the SCell;  5> PDCCH monitoring for the SCell;  5> PUCCH transmissions on the SCell, if configured.  .......  1> if the SCell is deactivated:  2> not transmit SRS on the SCell;  2> not report CSI for the SCell;  2> not transmit on UL-SCH on the SCell;  2> not transmit on RACH on the SCell;  2> not monitor the PDCCH on the SCell;  2> not monitor the PDCCH for the SCell;  2> not transmit PUCCH on the SCell.  -------------------------------------------END ----------------------------------------------------------  In the section 5.9 of TS 38.321, “not monitor PDCCH for SCell” behavior is used in the deactivated state. Then in the following, we discuss the understanding for it in the deactivated state firstly. In our opinion, there are two different understanding as below:   * Understanding 1: the UE expects that all detected PDCCHs sent by other active cells do not contain information for the deactivated cell. * Understanding 2: the UE ignores information for the deactivated SCell if the detected PDCCHs sent by other active cells contain information for it, such as ap-CSI-RS or SFI.   For understanding 1, NW cannot perform cross-carrier scheduling of PDSCH/PUSCH and cross-carrier triggering of ap-CSI-RS because one serving cell is in the deactivated state. For DCI format 2\_0, if the deactivated cell is not included in the list of SFI or removed from the list of SFI via RRC reconfiguration message before deactivation, SFI information will not be indicated for it. For understanding 2, if the deactivated cell is configured in the list of SFI, it means that SFI information for it will be indicated by other active cells. For this case, it is better to ignore SFI information considering it is not helpful. In addition, for other information from other PDCCHs for the deactivated cell, they should be ignored similar to SFI.  For two understanding above, we think understanding 2 is a correct understanding. Firstly, if the deactivated cell is included in SFI list, NW is able to indicate SFI information to the UE quickly once SCell is activated. Secondly, since the serving cell is in deactivated state, the received information are not meaningful at that moment. So they should be ignored.  **Proposal 1: UE is not required to use information carried in DCI for a deactivated SCell that is transmitted on other activated cell.**  Actually, only the operations for deactivated state and activated state are specified in TS 38.321, while the operation for being-activated state in Figure 1 is unclear.    Figure 1: The state switching of the SCell  According to the timing defined in TS 38.213 for MAC CE activation and according to the timing defined in TS 38.133 for SCell activation, the active SCell will recover normal SCell operation (after point B in Figure 1), including PDCCH monitoring on/for the SCell. For being-activated SCell, the spec does not clearly define the UE behavior on PDCCH monitoring. But according to the description of section 4.3 in TS 38.213 [5], the UE should maintain the same PDCCH behaviors as in the deactivated SCell.  **Proposal 2: For being-activated SCell, UE maintains the same PDCCH monitoring behavior as clarified for the deactivated SCell in Proposal 1.**  In addition, there are two opinions on whether “the section 11 UE-group common signalling” in TS 38.213 is also applicable to a being-activated SCell, as follows:   * Opt 1: Section 11 in TS 38.213 is applied for an active cell and a being activated SCell. * Opt 2: Section 11 in TS 38.213 is only applied for an active cell.   Considering that UE is not required to use any information carried in DCI for the being activated SCell, we prefer Opt 2.  **Proposal 3: On whether “the section 11 UE-group common signalling” in TS 38.213 is also applicable to a being-activated SCell, the following two options can be considered. Among them, Opt 2 is preferred.**   * **Opt 1: Section 11 in TS 38.213 is applied for an active cell and a being activated SCell** * **Opt 2: Section 11 in TS 38.213 is only applied for an active cell** |

# Email Discussion

## Phase-1: Collection of companies’ views

**Q1:** On how to interpret “not monitoring PDCCH for SCell” in the section 5.9 of TS 38.321, please provide your views.

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| **Company** | **Comment** |
| Huawei, HiSilicon | Und. #1: UE expects that all detected PDCCHs sent by other active cells do not contain information for the deactivated cell.  213 defines that  “*A UE monitors a set of PDCCH candidates in one or more CORESETs on the active DL BWP on each activated serving cell configured with PDCCH monitoring according to corresponding search space sets where monitoring implies decoding each PDCCH candidate according to the monitored DCI formats*”  Thus no monitoring mean no decoding from UE – Und.#2 does not hold as the UE cannot decode a PDCCH (and ignore irrelevant information). |
| Qualcomm | Understanding 2 is reasonable:   * Understanding 2: the UE ignores information for the deactivated SCell if the detected PDCCHs sent by other active cells contain information for it, such as ap-CSI-RS or SFI. |
| LG Electronics | We agree with Understanding 2.  From our understanding, “not monitoring PDCCH for SCell” in the section 5.9 of TS 38.321 does not prevent UE from monitoring DCI 2\_0 that is transmitted on PCell (or other already activated SCell) but can contain SFI (or CO-duration for NR-U cell) configured for being-activated SCell. Also, it does not rule out monitoring UL grant (on other activated cell) that may trigger aperiodic CSI-RS on being-activated SCell. Nevertheless, in the context of preventing UE from monitoring any PDCCH “on” and “for” the being-activated SCell, above 38.321 specification can be interpreted such that UE is not required to use any information of being-activated SCell in a DCI which is transmitted on other activated cell even though UE detects the DCI 2\_0 or UL grant triggering aperiodic CSI-RS on being-activated SCell. |
| Spreadtrum | For ap-CSI-RS or SFI, we think it is understanding 2. Since the mapping of SCell and SFI indication in DCI 2\_0 has been configured, DCI 2\_0 can be sent in this case.  For UL or DL grant DCI, we think it is understanding 1. |
| Ericsson | The “not monitoring PDCCH for SCell” is related to cross-carrier scheduling (i.e., the SS candidates and corresponding DCI format sizes are not monitored). No further clarification for 38.321 spec text is needed (this has been same text for several LTE/NR releases)  According to 38.213 sub-clause 4.3, the CSI reporting timeline for the UE is from slot n+k and for other actions it is at a later slot. This is also case with 38.133 sub-clause 8.3.2 (CSI reporting parts). So, the Understanding 1 or 2 are contrary to what is already specified in 38.213 and 38.133.  In summary we do not see need for any clarification. |
| ASUSTeK | In general, we agree with Ericsson that “not monitoring PDCCH for SCell” is intended for the case of cross-carrier scheduling, while we also see not harm to apply the same behavior for SFI/aperiodic CSI-RS. What is the exact difference between “not monitor” and “monitor but ignore”? Note that the standard does not prohibit NW to perform any scheduling though logically NW would not send a DCI that no one is going to monitor. |
| DOCOMO | We share the same view as Ericsson. No further clarification is needed. |
| ZTE, Sanechips | For “not monitoring PDCCH on SCell” in the section 5.9 of TS 38.321, we think that UE does not monitor and decode any PDCCH on the deactivated SCell.  For “not monitoring PDCCH for SCell” in the section 5.9 of TS 38.321, our understanding is that UE can monitor PDCCH on other active cells. If control information for the deactivated SCell is carried by PDCCHs transmitted on the other active cells, one question needs to further be clarified, that is, how does the UE handle the PDCCHs and the information for the deactivated SCell?  Take SFI in DCI format 2\_0 as an example, if the deactivated cell is configured in the list of SFI, it means that SFI information for the deactivated cell will be indicated by other active cells, which shows the above scenarios of cross-carrier indication for the deactivated SCell exists. Obviously, UE should monitor and decode these PDCCHs transmitted on other active cells. But since the SCell is in deactivated state, the received information are not meaningful at that moment. So they should be ignored. Therefore we prefer Understanding 2. |
| Samsung | Understanding 2: the UE ignores information for the deactivated SCell if the detected PDCCHs sent by other active cells contain information for it, such as ap-CSI-RS or SFI. |
| Sharp | We share the same views with LG. For DCI 2\_0, Understanding 2 is more appropriate. |
| Intel | We agree with understanding #2. It is possible that DCI 2\_0 or A-CSI triggering DCI is detected on another activated cell, which indicates the information of the to-be-activated cell. In this case, such information of the to-be-activated cell is neglected.   * After slot n+k, a DCI triggering A-CSI feedback is considered as valid. If UE detects a DCI other than A-CSI triggering DCI on another activated cell, the information of the to-be-activated cell is neglected. * After the later slot [38.133], all detected DCIs are considered valid. |
| Apple | Understanding 2. |
| vivo | We agree with understanding 2 which is more reasonable. |

**Q2:** If there is no consensus on Q1, do you agree to send an LS to RAN2 to clarify the understanding on “not monitoring PDCCH for SCell ” in the section 5.9 of TS 38.321. please provide your views.

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| **Company** | **Comment** |
| Huawei, HiSilicon | No need. The spec is clear. |
| Qualcomm | Yes, RAN1 should inform RAN4 the outcome of RAN1 discussion even though there is no consensus and have RAN2 CC’ed. |
| LG Electronics | We prefer to solve this issue in RAN1, but if we cannot reach a consensus, sending an LS to RAN2 can be considered. |
| Spreadtrum | We prefer a conclusion in RAN1 first. |
| Ericsson | We do not see need for this (there was also no RAN2 request for this). |
| ASUSTeK | Consult RAN2 only if RAN1 could not resolve the issue. |
| DOCOMO | We do not see need for clarification. |
| ZTE, Sanechips | Yes.  When RAN1 reaches some conclusions/agreements on Q1 at this meeting,   * if such consensus does not affect RAN2’s spec such as TS 38.321, then RAN1 cannot send an LS to inform RAN2 about RAN1’s understanding on this issue. * Otherwise, an LS is needed to be sent to RAN2.   If RAN1 has no consensus or conclusion on Q1, then RAN1 can send an LS to RAN2 to confirm the understanding on “not monitoring PDCCH for SCell ” in the section 5.9 of TS 38.321. |
| Samsung | We do not see the need for sending LS. |
| Sharp | No need at this moment. |
| Intel | We prefer to solve the issue in RAN1. |
| Apple | We prefer to solve it in RAN1. If NOT, sending an LS to RAN2 to seek for clarification is reasonable as TS 38.321 is maintained by RAN2. |
| vivo | OK to send a LS to RAN2 if RAN1 can’t solve it. |

**Q3:** On “the section 11 UE-group common signalling” in TS 38.213, please provide your views and reasons for the following:

* Alt 1: Section 11 in TS 38.213 is applied for an active cell and a being activated SCell
* Alt 2: Section 11 in TS 38.213 is only applied for an active cell

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| **Company** | **Comment** |
| Huawei, HiSilicon | Alt 2 |
| Qualcomm | For the being activated SCell, UE behavior is transient. For such transient, it is unnecessary to align different companies’ implementation and it is meaningless to create testing cases. Then there is no need to specify UE behavior during this transient duration. Based on this, we propose the alternative 3:   * Alt 3: UE behavior for a being activated SCell is not specified. |
| LG Electronics | We support Alt 2, and Alt 3 suggested by Qualcomm is also fine to us. |
| Spreadtrum | We agree with Qualcomm. Alt 3 is preferred. |
| Ericsson | The activation timeline for different UE actions is specified in 38.213. There is no need to define a ‘being activated state’ in RAN1 spec or to clarify the UE behavior within it. If companies see the need to clarify timeline for a certain UE action, then that case and proposed TP etc. for it should be discussed directly. |
| ASUSTeK | Alt 2 but fine with Alt 3 as well. |
| DOCOMO | Alt.2 but fine with Alt.3 as well. |
| ZTE, Sanechips | As we prefer that UE is not required to use any information carried in DCI for the being activated SCell, we slightly prefer Alt 2. We are also open to Alt 3 to retain implementation flexibility. |
| Samsung | We support Alt3. |
| Sharp | We agree with Qualcomm. Alt 3 is preferred. |
| Intel | Alt.2 but fine with Alt.3 as well. |
| Apple | Alt.2. We are also fine with Alt.3 as proposed by Qualcomm. |
| vivo | Alt.2 and fine with Alt. 3. In our understanding, Alt. 2 and Alt. 3 are not [contradictory](http://www.baidu.com/link?url=a6fyq3f8IuDe6Awe2gJhoQOAoRA9ZBVlGUcF78xU2y86perWWadTkI9rtRKxYr_aoib8r5_MWHvw1ZUBVGof27y4Ptb1ixw7byi8FTqQJte). Even we conclude that Section 11 in TS 38.213 is only applied for an active cell， it also implies that UE behavior for a being activated SCell is not specified. |

## Phase-2: Summary

Based on the collected views from companies in Phase-1, the following is observed:

Regarding **Q1**, companies have different views on how to interpret “not monitor PDCCH for SCell when SCell is in the deactivated state”, which can be classified as:

* Understanding 1: the UE expects that all detected PDCCHs sent by other active cells do not contain information for the deactivated cell.
  + Supported by (2): Huawei, Spreadtrum(only for UL/DL grant DCI)
* Understanding 2: the UE ignores information for the deactivated SCell if the detected PDCCHs sent by other active cells contain information for it, such as ap-CSI-RS or SFI.
  + Supported by (9): Qualcomm, LGE, Spreadtrum(for AP-CSI-RS or SFI), ZTE, Samsung, Sharp(for DCI 2-0), Intel, Apple, vivo
* Understanding 3: TS 38.321 spec is clear and no need to be clarified, that is, “not monitoring PDCCH for SCell” in the section 5.9 of TS 38.321 is intended for the case of cross-carrier scheduling.
  + Supported by (3): Ericssion, ASUSTeK, DOCOMO

Wherein, the potential difference between Understanding 2 and understanding 3 is how the UE handle the information contained in PDCCH detected on activated cell for the deactivated SCell.

Regarding **Q2**, it seems companies that can accept sending LS to RAN2 is comparable with that does not agree to sending LS. Wherein, 2 companies (Huawei, Ericssion) think the spec is clear and there is no need to consult RAN2, 4 companies (DOCOMO, Samsung, Sharp, Intel) think there is no a need to send an LS to RAN2 as long as the issue can be solved in RAN1, while 6 companies seems to be acceptable to send LS to RAN2, but specific views are slightly different, such as, 1 company (Spreadtrum) suggested a conclusion on Q1 should be achieved in RAN1 first, 4 companies (LGE, ASUSTek, Apple, vivo) proposed that an LS can be sent only if RAN1 has not reached a consensus on Q1, 2 companies(Qualcomm, ZTE) support to send an LS to RAN2 to inform the outcome of RAN1 discussion regardless of whether RAN1 has a consensus or seek for clarification on the description “not monitoring PDCCH for SCell if SCell is deactivated” in section 5.9 of TS 38.321.

Regarding **Q3**, Alt3 (UE behavior for a being activated SCell is not specified) proposed by Qualcomm seems to be acceptable for most of companies.

Based on above summary for each question, Moderator suggest trying to further discuss the following proposal 1 and proposed conclusion:

**Proposal 1:**

On how to interpret “not monitoring PDCCH for SCell” in the section 5.9 of TS 38.321

* Alt. 1: Take understanding 2 (majority) as the conclusion
* Alt. 2: Summarize the current status on the different understandings and inform RAN4/RAN2.

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| **Company** | **Comment** |
| Qualcomm | We support Alt. 1 |
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**Proposed conclusion**: UE behavior for a being activated SCell is not specified

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| **Company** | **Comment** |
| Qualcomm | We support the proposed conclusion. |
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# Outcome of Email Discussion

The final proposals will be added later.

# References

1. [R1-2107008](file:///C:\working_document\3GPP_5G_standadization\Rel-17%20NR-U\Meetings\RAN1%23106\Docs\R1-2107008.zip) On the PDCCH monitoring behavior during SCell activation, RAN1, ZTE, Sanechips
2. R1-2100008 LS on measuring CSI-RS during SCell activation, RAN4, Ericsson
3. [R1-2102011](file:///C:\working_document\3GPP_5G_standadization\Rel-17%20NR-U\Meetings\RAN1%23106\Offline\Docs\R1-2102011.zip) Reply LS on measuring CSI-RS during SCell activation, RAN1, Lenovo