**3GPP TSG RAN WG1#104e R1-2nnnnnn**

**e-Meeting, January 25th – February 5th, 2021**

**Agenda Item: 7.2.2**

**Source: Moderator (Lenovo)**

**Title: Email discussion/approval [104-e-NR-NRU-05] on reply LS to R1-2100008**

**Document for: Discussion, Decision**

This document summarises the discussion on the following topics:

[104-e-NR-NRU-05] Email discussion/approval of the reply LS to R1-2100008 **until Jan-29** – Alex (Lenovo)

First, the corresponding behaviour should be clarified within RAN1. The detailed reply LS will be discussed as a second step.

# Incoming LS from RAN4 (R1-2100008)

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| 1. **Overall Description:**   RAN4 would like to inform RAN1 that in Rel-16 RAN4 is working on the SCell activation delay requirements under the following assumption regarding CSI reporting during the SCell activation:   * When P/SP-CSI-RS is configured for CSI reporting during the SCell activation, it is assumed that at least one of the RRC parameters CO-DurationPerCell-r16, SlotFormatIndicator, and CSI-RS-ValidationWith-DCI-r16 is configured for a UE and the UE supports the corresponding capability, so that the UE measures the configured P/SP-CSI-RS and transmits CSI reports during the SCell activation period, except for the cases when the UE cancels the reception of CSI-RS according to TS 38.213.   RAN4 would also like to ask about the UE behavior with respect to CSI reports during the SCell activation procedure in case none or some of these three RRC parameters are configured with or without corresponding DCIs for the SCell being activated. For example:  (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?  (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,  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 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?  (3)   When RRC parameters CO-DurationPerCell-r16 is configured but SlotFormatIndicator is not 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 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?  (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?  **2. Actions:**  **To RAN1 group:**  **ACTION:** RAN4 kindly asks RAN1 to take the above information into account in their work and provide the feedback on the UE behavior. |

# Discussion for cases identified by RAN4

## Case (1)

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| (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? |

Ericsson (R1-2001305):

As in Rel-15, the UE is expected to receive the p/sp-CSI-RS, except if the UE receives a DCI that schedules/triggers an UL signal/channel in one or more of the symbols occupied by p/sp-CSI-RS.

LG (R1-2100888):

When none of the RRC parameters of *CO-DurationsPerCell*, *SlotFormatCombinations PerCell*, and *csi-RS-ValidationWithDCI-r16* is configured for a UE on the being-activated SCell, the UE behaviour for P/SP CSI-RS measurement and report on the being-activated SCell is the same with that on the activated SCell.

vivo (R1-2101156):

UE will proceed with the P/SP CSI-RS measurement and report on the being-activated SCell.

Samsung (R1-2101164):

Therefore, when none of the RRC parameters are not configured for the UE, the UE cancels/receives the higher-layer configured periodic and semi-persistent CSI-RS reception according to current Clause 11.1 of TS38.213.

Nokia (R1-2101287):

According to TS 38.321, the UE is not expected to monitor PDCCH on or for the to-be-activated SCell until the time given by the minimum time requirement defined in in TS 38.133 has passed. Therefore, the UE has no certainty on the presence of CSI-RS on unlicensed spectrum. Hence, it is safest if the UE omits CSI reporting in this case, until the SCell has been activated according to the minimum time requirement.

Apple (R1-2101336):

According to section 5 of TS 38.321, for SCell activation, a UE is not required to monitor PDCCH for the SCell being activated before the minimum timing requirement defined in TS 38.133. Consequently, DCI-based P/SP-CSI-RS validation mechanism defined by RAN1 for NR-U operation cannot be used to validate P/SP-CSI-RS on the SCell being activated. RAN1 therefore recommends RAN4 to define SCell activation latency requirement for NR-U based on the assumption that a UE always assumes the presence of configured P/SP-CSI-RS on the SCell being activated for CSI report during SCell activation procedure without validation, including all of the four examples listed in R1-2100008.

Huawei (R1-2101747):

It was agreed that the UE cancels/receives the higher-layer configured periodic and semi-persistent CSI-RS reception according to current Clause 11.1 of TS 38.213 when none of *CO-DurationPerCell-r16*, *SlotFormatIndicator*, and *CSI-RS-ValidationWith-DCI-r16* is configured for all cases. So on the being-activated SCell, UE should follow the same rules as Clause 11.1 without exception.

**Q1: Can we agree on the following for Case (1)?**

As in Rel-15, the UE is expected to receive the p/sp-CSI-RS, except if the UE receives a DCI that schedules/triggers an UL signal/channel in one or more of the symbols occupied by p/sp-CSI-RS.

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| Company | Comments |
| Apple | As pointed out in our paper [R1-2101336], Rel-15/16 UE is not required to monitor DCI ‘**for’** the SCell being activated before minimum timing requirement in accordance with TS 38.213 and TS 38.321. As also emphasized in paper, revisiting this behavior to request UE monitor DCI for NR-U is not only impact on Rel-16 but also Rel-15 UE behavior such as DCI 2\_0 SFI monitoring on other active CCs for the SCell being activated. It should be avoided at this last minute in maintenance phase; otherwise, different UE behaviors have to be implemented for unlicensed SCell activation.  Assuming the Rel-15/16 specification is maintained, and UE does not require to monitor DCI ‘for’ the SCell being activated, we suggest to rephase the proposal as follows:  As in Rel-15, the UE is expected to receive the p/sp-CSI-RS~~, except if the UE receives a DCI that schedules/triggers an UL signal/channel in one or more of the symbols occupied by p/sp-CSI-RS~~ |
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## Case (2)

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| (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,  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 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? |

Ericsson (R1-2001305):

The UE is expected to receive the p/sp-CSI-RS in a slot only if it decodes a DCI format indicating ap-CSI-RS or scheduling a PDSCH reception in the set of symbols in the slot occupied by the p/sp-CSI-RS.

LG (R1-2100888):

When RRC parameter *csi-RS-ValidationWithDCI-r16* is configured, but *CO-DurationsPerCell* and *SlotFormatCombinationsPerCell* are not configured for a UE on a being-activated SCell, adopt one of the following two alternatives.

* Alt 1: The UE behaviour for P/SP CSI-RS reception on the being-activated SCell is the same with that on activated SCell, i.e., the UE can determine the validity of P/SP CSI-RS on being-activated SCell based on DCI detected on the being-activated SCell or on the other serving cell (if cross-carrier scheduling is configured).
* Alt 2: The UE behaviour for P/SP CSI-RS reception on the being-activated SCell is that the UE shall not cancel P/SP CSI-RS reception based on information of detected UE-specific DCI, if any, for the being-activated SCell, i.e., the UE assumes P/SP CSI-RS is always present and is not required to blindly detect its presence or absence.

vivo (R1-2101156):

Yes, UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot if the UE detects a DCI format indicating an aperiodic CSI-RS reception or scheduling a PDSCH reception in the set of symbols of the slot; otherwise, UE cancels the CSI-RS reception.

Samsung (R1-2101164):

As specified in Clause 11.1 of TS38.213, *for operation with shared spectrum channel access, if a UE is provided CSI-RS-ValidationWith-DCI-r16, is not provided CO-DurationPerCell-r16, and is not provided SlotFormatCombinationsPerCell, and if the UE is configured by higher layers to receive a CSI-RS in a set of symbols of a slot, the UE cancels the CSI-RS reception in the set of symbols of the slot if the UE does not detect a DCI format indicating an aperiodic CSI-RS reception or scheduling a PDSCH reception in the set of symbols of the slot.* Therefore, it is our understanding that the UE needs to decode a DCI format from other active serving cell for this activated SCell to validate P/SP-CSI-RS.

Nokia (R1-2101287):

Since the UE is not expected to monitor PDCCH during SCell activation, the UE behavior is the same as in case (1), i.e. the UE may omit CSI reporting until the SCell has been activated.

Apple (R1-2101336):

According to section 5 of TS 38.321, for SCell activation, a UE is not required to monitor PDCCH for the SCell being activated before the minimum timing requirement defined in TS 38.133. Consequently, DCI-based P/SP-CSI-RS validation mechanism defined by RAN1 for NR-U operation cannot be used to validate P/SP-CSI-RS on the SCell being activated. RAN1 therefore recommends RAN4 to define SCell activation latency requirement for NR-U based on the assumption that a UE always assumes the presence of configured P/SP-CSI-RS on the SCell being activated for CSI report during SCell activation procedure without validation, including all of the four examples listed in R1-2100008.

Huawei (R1-2101747):

The motivation to introduce the feature of *CSI-RS-ValidationWith-DCI* is to help UE determine whether gNB transmit the P/SP-CSI-RS after LBT. Considering there is no differentiation between serving cell or being-activated SCell during the discussion, we think the feature of *CSI-RS-ValidationWith-DCI* should be applied to both being-activated Scell and active serving cell. If UE receive DCI in an activated cell indicating AP-CSI-RS in the being-activated SCell in the set of symbols of the slot overlapping with the configured P/SP-CSI-RS, UE should receive and measure on the P/SP-CSI-RS. Otherwise, UE should cancel the P/SP-CSI-RS reception.

**Q2: Can we agree on the following for Case (2)?**

UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot if the UE detects a DCI format indicating an aperiodic CSI-RS reception or scheduling a PDSCH reception in the set of symbols of the slot; otherwise, UE cancels the CSI-RS reception.

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| Company | Comments |
| Apple | As commented for Q1, assuming the current specification is kept avoiding impact on Rel-15 UE behavior, a unified UE behavior needs to be defined since any DCI on other activated Cell is not monitored by UE. Hence, the following was suggested:  UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot ~~if the UE detects a DCI format indicating an aperiodic CSI-RS reception or scheduling a PDSCH reception in the set of symbols of the slot; otherwise, UE cancels the CSI-RS reception~~. |
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## Case (3)

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| (3)   When RRC parameters CO-DurationPerCell-r16 is configured but SlotFormatIndicator is not 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 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? |

Ericsson (R1-2001305):

The UE behaviour is slightly different depending on whether or not the DCI 2\_0 indicating the remaing CO duration is detected

Case 1: (DCI 2\_0 detected)

The UE is expected to receive the p/sp-CSI-RS as long as the set of symbols occupied by the CSI-RS are within remaining channel occupancy duration indicated by the CO duration field the detected DCI 2\_0. Ottherwise the CSI-RS reception is cancelled. The applicable rule in 38.213 Section 11.1.1 is as follows:

Case 2: (DCI 2\_0 not detected):

The UE is expected to receive the the p/sp-CSI-RS as long as the set of symbols occupied by the CSI-RS are within remaining channel occupancy duration indicated by the CO duration field of a *previously* detected DCI 2\_0. Otherwise the CSI-RS reception is cancelled.

LG (R1-2100888):

When one of *CO-DurationsPerCell* and *SlotFormatCombinationsPerCell* is configured for a UE on a being-activated SCell, adopt one of the following two alternatives.

* Alt 1: The UE behaviour for P/SP CSI-RS reception on the being-activated SCell is the same with that on activated SCell, i.e., the UE can determine the validity of P/SP CSI-RS on being-activated SCell based on DCI format 2\_0 detected on the being-activated SCell or on the other serving cell (if *CO-DurationsPerCell* or *SlotFormatCombinationsPerCell* corresponding to the being-activated SCell is provided with DCI format 2\_0 on the other serving cell).
* Alt 2: The UE behaviour for P/SP CSI-RS reception on the being-activated SCell is that the UE shall not cancel P/SP CSI-RS reception based on information of detected DCI format 2\_0, if any, for the being-activated SCell, i.e., the UE assumes P/SP CSI-RS is always present and is not required to blindly detect its presence or absence.

vivo (R1-2101156):

Yes, UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot if the UE decodes a DCI format 2\_0 indicating the set of symbols are within remaining channel occupancy duration; otherwise, UE cancels the CSI-RS reception.

Samsung (R1-2101164):

Therefore, it is our understanding that if CO-DurationPerCell-r16 is configured but SlotFormatIndicator is not configured for the being-activated SCell, the UE needs to decode a DCI format 2\_0 from other active serving cell for this being-activated SCell to validate the CSI-RS.

Nokia (R1-2101287):

Similarly as above, since the UE is not expected to monitor PDCCH during SCell activation, the UE behavior is the same as in case (1), i.e. the UE may omit CSI reporting until the SCell has been activated.

Apple (R1-2101336):

According to section 5 of TS 38.321, for SCell activation, a UE is not required to monitor PDCCH for the SCell being activated before the minimum timing requirement defined in TS 38.133. Consequently, DCI-based P/SP-CSI-RS validation mechanism defined by RAN1 for NR-U operation cannot be used to validate P/SP-CSI-RS on the SCell being activated. RAN1 therefore recommends RAN4 to define SCell activation latency requirement for NR-U based on the assumption that a UE always assumes the presence of configured P/SP-CSI-RS on the SCell being activated for CSI report during SCell activation procedure without validation, including all of the four examples listed in R1-2100008.

Huawei (R1-2101747):

According to RAN1 agreement, UE will cancel the P/SP-CSI-RS reception if the configured resource is outside of the COT indication. It helps UE to determine whether the P/SP-CSI-RS is transmitted by gNB after LBT. As the COT duration of a being-activated SCell can be carried in a DCI 2\_0 in another active serving cell, the cross carrier indication of COT duration can still help UE to determine whether the configured CSI-RS is in the COT. So UE could 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

**Q3: Can we agree on the following for Case (3)?**

UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot if the UE decodes a DCI format 2\_0 indicating the set of symbols are within remaining channel occupancy duration; otherwise, UE cancels the CSI-RS reception.

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| Company | Comments |
| Apple | Same comments as for Q1, the following modification is suggested to avoid changes on current specification and UE behaviors:  UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot ~~if the UE decodes a DCI format 2\_0 indicating the set of symbols are within remaining channel occupancy duration; otherwise, UE cancels the CSI-RS reception.~~ |
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## Case (4)

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| (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? |

Ericsson (R1-2001305):

The UE behaviour depends on whether or not the DCI 2\_0 containing the SFI is detected.

Case 1: (DCI 2\_0 detected):

The UE is expected to receive the p/sp-CSI-RS only if the set of symbols in the slot occupied by the p/sp-CSI-RS are indicated as 'D' by the SFI field in the detected DCI 2\_0. Since CO-DurationPerCell-r16 is not provided, the UE assumes that the symbols indicated by SFI are within the remaining channel occupancy

Case 2: (DCI 2\_0 not detected):

The UE cancels reception of the the p/sp-CSI-RS since CO-DurationPerCell-r16 is not provided.

LG (R1-2100888):

When one of *CO-DurationsPerCell* and *SlotFormatCombinationsPerCell* is configured for a UE on a being-activated SCell, adopt one of the following two alternatives.

* Alt 1: The UE behaviour for P/SP CSI-RS reception on the being-activated SCell is the same with that on activated SCell, i.e., the UE can determine the validity of P/SP CSI-RS on being-activated SCell based on DCI format 2\_0 detected on the being-activated SCell or on the other serving cell (if *CO-DurationsPerCell* or *SlotFormatCombinationsPerCell* corresponding to the being-activated SCell is provided with DCI format 2\_0 on the other serving cell).
* Alt 2: The UE behaviour for P/SP CSI-RS reception on the being-activated SCell is that the UE shall not cancel P/SP CSI-RS reception based on information of detected DCI format 2\_0, if any, for the being-activated SCell, i.e., the UE assumes P/SP CSI-RS is always present and is not required to blindly detect its presence or absence.

vivo (R1-2101156):

Yes, UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot if the UE decodes a DCI format 2\_0 indicating the set of symbols are downlink symbols; otherwise, UE cancels the CSI-RS reception.

Samsung (R1-2101164):

Therefore, if SlotFormatIndicator is configured but CO-DurationPerCell-r16 is not configured for the being-activated SCell, it is RAN1 understanding that the UE follows existing Rel-15 specification (e.g., Section 11.1.1 of TS38.213).

Nokia (R1-2101287):

Again, since the UE is not expected to monitor PDCCH during SCell activation, the UE behavior is the same as in case (1), i.e. the UE may omit CSI reporting until the SCell has been activated.

Apple (R1-2101336):

According to section 5 of TS 38.321, for SCell activation, a UE is not required to monitor PDCCH for the SCell being activated before the minimum timing requirement defined in TS 38.133. Consequently, DCI-based P/SP-CSI-RS validation mechanism defined by RAN1 for NR-U operation cannot be used to validate P/SP-CSI-RS on the SCell being activated. RAN1 therefore recommends RAN4 to define SCell activation latency requirement for NR-U based on the assumption that a UE always assumes the presence of configured P/SP-CSI-RS on the SCell being activated for CSI report during SCell activation procedure without validation, including all of the four examples listed in R1-2100008.

Huawei (R1-2101747):

There is a conclusion in RAN1 that Rel-15 mechanism should be applied when only SFI is configured. So the validation rule in section 11.1.1 with only SFI configured should be applied no matter it is an active serving cell or being activated SCell.

**Q4: Can we agree on the following for Case (4)?**

UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot if the UE decodes a DCI format 2\_0 indicating the set of symbols are downlink symbols; otherwise, UE cancels the CSI-RS reception.

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| Company | Comments |
| Apple | As commented in earlier question, UE is not required to monitor DCI ‘for’ the being activated SCell until now and this should be maintained to avoid change on UE implementation at this late stage. Hence, the following was suggested:  UE proceeds with the P/SP CSI-RS measurement in the set of symbols of the slot ~~if the UE decodes a DCI format 2\_0 indicating the set of symbols are downlink symbols; otherwise, UE cancels the CSI-RS reception.~~ |
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## General

**Q5: Is there any additional information RAN1 should provide to RAN4?**

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| Company | Comments |
| Apple | It is good to point out the relevant specification to RAN4 as evidence that UE is not required to monitor DCI ‘on’ and ‘for’ the SCell being activated. Hence, the validation rule defined in RAN1 for active NR-U SCell is not applicable during SCell activation process. |
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