**3GPP TSG-RAN WG2 Meeting #131bis R2-250xxxx**

**Prague, Czech Republic, Oct. 13th-17th, 2025**

**Agenda item: 8.12.1**

**Source: Samsung**

**Title: Report of Rel-19 MIMO MAC open issues for maintenance**

**WID/SID: NR\_MIMO\_Ph5**

**Document for: Discussion and Decision**

# Introduction

This offline discussion aims to collect Rel-19 MIMO MAC open issues for maintenance according to the instruction below indicated in email thread **[POST131][000][Organizational] Schedule and Agenda** and in the RAN2#131bis meeting agenda.





The following CR review offline discussion is used to expand the scope to gather open issues.

* [Post131][217][MIMO\_Ph5] CR for TS 38.321 (Samsung)

Intended outcome: Agree the CR for TS 38.321

Deadline:

1. Initial list of open issues by rapporteur, proposed resolutions for easy open issues or resolution options for other issues: sept. 19th
2. Inputs from other companies and identification of issues that require contribution input: Sept. 26th
3. Final set of proposals and resolutions for issues that don’t require contribution input: Oct. 1st

For phase-1 discussion, companies are invited to provide identified open issues and the corresponding suggested solutions by **Sep. 19th 1000 UTC**, so that Rapporteur can summarize the issues to be discussed in phase-2.

For phase-2 discussion by **Sep. 26th 1000 UTC**, companies please share views on the issues summarized by the Rapporteur. Based on the comments, Rapporteur will list the easy issues with promising solutions and the controversial issues to be further discussed based on tdoc contribution. Please continue to share identified issues that requires contribution input if not provided in phase-1 discussion.

Companies are encouraged to spend time early to identify open issues and utilize this offline discussion to provide inputs in order to facilitate the tdoc preparation and the discussion at RAN2#131bis.

# Discussion

For phase-1 discussion by Sep 19th 1000 UTC, please provide the description of the identified issues and the potential solutions. As the outcome of phase-1 discussion, Rapporteur will indicate the issues to be discussed in phase-2. Some easy issues may not need phase-2 discussion.

* The identified issue should have potential MAC impact. Issues can include the ones discussed/proposed in RAN2 before but not solved/concluded, the ones with RAN2 impact caused by other WG (e.g., RAN1) but not identified before, and so on.
* For the proposed solution, companies are encouraged to provide the detailed TP, or if not possible, a high-level proposal at least.

For phase-2 discussion by Sep 26th 1000 UTC, please provide comments on the issues/solutions/TPs listed in phase-1 discussion outcome. Please continue to share identified issues that requires contribution input if not provided in phase-1 discussion.

Companies are also encouraged to indicate miscellaneous and non-controversial issues (including editorial issues) here. Such issues can be provided until Oct. 1st and will be directly handled in the Rapporteur CR to be submitted to RAN2#131bis.

Please use the template below and fill in each block for one issue.

# [ASUSTeK] [Issue-1]

**[Issue Description]**:

The PUCCH resource of a UEI report configuration of a SCell can be configured on a PUCCH Cell associated with a different TAG from the SCell:



Currently, in this case, when TAT of a TAG of the SCell expires and PUSCH transmission for the CSI report becomes unavailable, the PUCCH resource of a UEI report configuration of the SCell is not released when the PUCCH resource is configured on a PUCCH Cell with a different TAG. This will cause unnecessary PUCCH transmission and the PUCCH resource will be occupied by the UE and cannot be reallocated for other uses. In addition, if RAN2 decides to not release PUCCH resource in this case, behavior of UEI beam reporting should be clarified when no PUSCH is available for CSI report (i.e., whether the UE still transmits the PUCCH when no PUSCH is available for CSI report).

**[Proposed Solution]**:

**Proposal 1: RAN2 to select from one of the options for UEI beam reporting in the following scenario: Upon STAG TAT expiry associated with a SCell configured with a UEI report configuration, if the PUCCH resource of the UEI report configuration is configured on a PCell or PUCCH-SCell of a different TAG with a running TAT, the UE:**

* + - * **Option 1: releases the PUCCH resource.**
      * **Option 2a: does not release the PUCCH resource. If a UEI beam report is triggered for the SCell, the UE transmits the PUCCH and does not transmit the PUSCH for the UEI beam report.**
      * **Option 2b: does not release the PUCCH resource. If a UEI beam report is triggered for the SCell, the UE does not transmit the PUCCH for the UEI beam report.**

**Proposal 2: Based on the selected option in P1, RAN2 to discuss spec impact for handling UEI report upon SCell TAT expiry.**

Possible TPs for each option are as below:

TP for option 1 (38.331):

|  |
| --- |
| 5.3.12 UE actions upon PUCCH/SRS release request  Upon receiving a PUCCH release request from lower layers, for all bandwidth parts of an indicated serving cell the UE shall:   1. release PUCCH-CSI-Resources configured in *CSI-ReportConfig*;   1> release PUCCH-CSI-Resources configured in *LTM-CSI-ReportConfig*;  1> release *SchedulingRequestResourceConfig* instances configured in *PUCCH-Config*;   1. release *pucch-Resource* configured in the *CSI-ReportUE-IBR*;   1> if the indicated serving cell is referred to by *pucch-Cell* included in *CSI-ReportUE-IBR* of an associated *CSI-ReportConfig*;  2> release *pucch-Resource* indicated in the associated *CSI-ReportUE-IBR*; |

TP for option 2 (38.321):

|  |
| --- |
| 5.2 Maintenance of Uplink Time Alignment  …  1> when a *timeAlignmentTimer* expires:  …  2> else:  3> if the *timeAlignmentTimer* is associated with a TAG for an SCell configured with only this TAG; or  3> if the *timeAlignmentTimer* is associated with a TAG for an SCell, and if the SCell is configured with two TAGs and *the timeAlignmentTimer* associated with the other TAG is not running:  4> flush all HARQ buffers for all such SCells;  4> notify RRC to release PUCCH, if configured on all such SCells;  4> notify RRC to release SRS, if configured for all such SCells;  4> clear any configured downlink assignments and configured uplink grants for all such SCells;  4> clear any PUSCH resource for semi-persistent CSI reporting for all such SCells;  4> maintain NTA (defined in TS 38.211 [8]) of this TAG.  … |

TP for option 2a (change can also be made in 38.321):

|  |
| --- |
| (38.214)  5.2.1.5.4 UE Initiated reporting  …  If the number of event instances determined by the counter for such reference signal is greater than or equal to *eventInstanceCount*, the UE transmits UEIRI on a PUCCH format 0 or format 1 in the PUCCH resource (in the CC provided by *pucchCell,* if configured, in the *CSI-ReportConfig*) configured by *PUCCHResource* in the *CSI-ReportConfig*. If *timeAlignmentTimer* associated with the Cell configured with the *CSI-ReportConfig* expires, the UE does not send a CSI report via PUSCH resource after transmission of UEIRI. |

TP for option 2b (change can also be made in 38.321):

|  |
| --- |
| (38.214)  5.2.1.5.4 UE Initiated reporting  …  If the number of event instances determined by the counter for such reference signal is greater than or equal to *eventInstanceCount* and *timeAlignmentTimer* associated with the Cell configured with the *CSI-ReportConfig* is running, the UE transmits UEIRI on a PUCCH format 0 or format 1 in the PUCCH resource (in the CC provided by *pucchCell,* if configured, in the *CSI-ReportConfig*) configured by *PUCCHResource* in the *CSI-ReportConfig*. |

#### **[Phase-2 Discussion]:**

Which option do you agree?

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1/2a/2b/other** | **Comments to the proposal and TP** |
| CATT | Option 1 | Regarding the TP, we have a different view. The release of PUCCH by RRC is indicated by the lower layer. And thus this case had been covered by the following description in the RRC spec,  1> if the indicated serving cell is referred to by *pucch-Cell* included in *CSI-ReportUE-IBR* of an associated *CSI-ReportConfig*;  2> release *pucch-Resource* indicated in the associated *CSI-ReportUE-IBR*;  Because anyway the lower layer will indicate which serving cell to release the corresponding PUCCH resource.  So the change should be made on the MAC spec to cover above scenario. We had captured the following last meeting agreement   * If the PUCCH of a UEI report configuration is pointed to a SCell whose TAT of the single sTAG is expired, this PUCCH for the SCell is released by RRC. If the type-1 CG of a UEI report configuration is pointed to a SCell whose TAT of the single sTAG is expired, this type-1 CG for the SCell is cleared as a configured UL grant. There is no MAC specification impact   by the following highlighted part,  1> when a *timeAlignmentTimer* expires:  …  2> else:  3> if the *timeAlignmentTimer* is associated with a TAG for an SCell configured with only this TAG; or  3> if the *timeAlignmentTimer* is associated with a TAG for an SCell, and if the SCell is configured with two TAGs and *the timeAlignmentTimer* associated with the other TAG is not running:  4> flush all HARQ buffers for all such SCells;  4> notify RRC to release PUCCH, if configured for all such SCells;  4> notify RRC to release SRS, if configured for all such SCells;  4> clear any configured downlink assignments and configured uplink grants for all such SCells;  5> if there is PUCCH resource referred to by *pucch-Cell* included in *CSI-ReportUE-IBR* of an associated *CSI-ReportConfig* that provides these configured uplink grants:  6> Notify RRC to release PUCCH for all such serving cells;  4> clear any PUSCH resource for semi-persistent CSI reporting for all such SCells;  4> maintain NTA (defined in TS 38.211 [8]) of this TAG.  Then we can further add a “5>” level description to cover this case, as implemented above. |
| Ofinno | Option 1 | Comments on Proposal: this issue only occurs for mode-B, so the proposal should avoid any impact on mode-A. Suggested revision:  **Proposal 1: RAN2 to select from one of the options for UEI beam reporting in the following scenario: Upon STAG TAT expiry associated with a SCell configured with a UEI report configuration for mode-B, if the PUCCH resource of the UEI report configuration is configured on a PCell or PUCCH-SCell of a different TAG with a running TAT, the UE:**  For Option 1, we prefer the TP proposed by CATT with a slight update. The PUCCH resource itself is not analogous as a cell, so it cannot be referred to by *pucch-Cell*. We added this PUCCH resource is configured on **a serving cell**. It's also clearer that notify RRC to release PUCCH is for this serving cell.  2> else:  3> if the *timeAlignmentTimer* is associated with a TAG for an SCell configured with only this TAG; or  3> if the *timeAlignmentTimer* is associated with a TAG for an SCell, and if the SCell is configured with two TAGs and *the timeAlignmentTimer* associated with the other TAG is not running:  4> flush all HARQ buffers for all such SCells;  4> notify RRC to release PUCCH, if configured for all such SCells;  4> notify RRC to release SRS, if configured for all such SCells;  4> clear any configured downlink assignments and configured uplink grants for all such SCells;  5> if there is PUCCH resource configured on a serving cell referred to by *pucch-Cell* included in *CSI-ReportUE-IBR* of an associated *CSI-ReportConfig* that provides these configured uplink grants:  6> notify RRC to release PUCCH for all such serving cells;  4> clear any PUSCH resource for semi-persistent CSI reporting for all such SCells;  4> maintain NTA (defined in TS 38.211 [8]) of this TAG. |
| Sharp | Option 1 | For Option 1, we prefer the TP proposed by CATT |
| ASUSTeK | Option 1 | We are fine to follow majority’s view on whether to handle both modes or mode-B only. Regarding TP for Option 1, we have no strong view and CATT’s MAC-based solution can also be considered. One comment is that PUCCH release should only be applied to the concerned PUCCH resource in CSI-ReportUE-IBR instead of all of the serving cells’ PUCCH. A slight update, for example:  4> clear any configured downlink assignments and configured uplink grants for all such SCells;  5> if there is PUCCH resource configured on a serving cell referred to by *pucch-Cell* included in *CSI-ReportUE-IBR* of an associated *CSI-ReportConfig* that provides these configured uplink grants:  6> notify RRC to release the PUCCH resource for all such serving cells; |
| Samsung | Option 2a or 2b | Disagree with Option 1.  PUCCH for UEI reporting is not dedicated for UEI reporting. Although it is a different PUCCH resource than SR, but it still can be used to transmit HARQ-ACK information or other CSI. There is no configuration restriction on this. So we think the PUCCH resource for mode-A/B should not be released if the associated TAT is still running since it can still be used to transmit HARQ-ACK information or other CSI.  Okay with Option 2a or 2b. We are fine to discuss for both mode-A and mode-B whether UE transmits the PUCCH when the associated PUSCH on another cell cannot be transmitted due to TAT expiry.  For option 2a (transmits PUCCH), UE can transmit PUCCH and then transmit the PUSCH at the first available occasion once TAT is recovered. Even if PUSCH is not transmitted, there is no harm to inform Report Indication in PUCCH. For this option, we don’t think any MAC change is needed, the current procedure is clear that PUCCH is released if it is configured for a SCell whose TAT is expired.  For option 2b (not release and not transmit PUCCH), we also need to specify the case that PUCCH cannot be transmitted due to TAT expiry but the TAT for PUSCH is still running, and in this case the associated PUSCH will not be transmitted as long as the PUCCH is not transmitted. We can discuss whether we need to specify in MAC or leave it to RAN1. The following is an example if we decide to specify in MAC.  Clause 5.2:  …  The MAC entity shall not perform any uplink transmission on a Serving Cell except the Random Access Preamble and MSGA transmission when the *timeAlignmentTimer*(s) associated with all TAG(s) to which this Serving Cell belongs is not running, CG-SDT procedure is not ongoing and Positioning SRS transmission in RRC\_INACTIVE as in clause 5.26 is not ongoing. Furthermore, when the *timeAlignmentTimer*(s) associated with all PTAG(s) is not running, CG-SDT procedure is not ongoing and Positioning SRS transmission in RRC\_INACTIVE as in clause 5.26 is not ongoing, the MAC entity shall not perform any uplink transmission on any Serving Cell except the Random Access Preamble and MSGA transmission on the SpCell. The MAC entity shall not perform any uplink transmission except the Random Access Preamble and MSGA transmission when the *cg-SDT-TimeAlignmentTimer* is not running during the ongoing CG-SDT procedure as triggered in clause 5.27 and the *inactivePosSRS-TimeAlignmentTimer* or *inactivePosSRS-ValidityAreaTAT* is not running. The MAC entity shall not perform any uplink transmission except the Random Access Preamble and MSGA transmission on a Serving Cell using TCI state(s) associated with a TAG for which the *timeAlignmentTimer* is not running.  For UE-initiated CSI reporting, if either the PUCCH or the associated PUSCH is associated with a TAG for which is not running, the PUCCH and the associated PUSCH are not transmitted. |
| Nokia | Option 1 | Updated TP by Ofinno looks clearer. To me, it sounds reasonable to release the PUCCH resource in the above mentioned case as the it will improve the resource efficiency. |

Rapporteur summary:

# [Sharp] [Issue-2]

**[Issue description]**:

For the UE initiated beam measurement report transmission configured with Mode B, PUCCH resource could be configured in a dedicated BWP while PUSCH resource could be configured in another dedicated BWP.

CSI-ReportUE-IBR-r19 ::= SEQUENCE {

...

reportTransmissionMode-r19 CHOICE {

modeA-r19 NULL,

modeB-r19 SEQUENCE {

pusch-ResourceOfModeB-r19 SEQUENCE {

configuredGrantConfigIndex-r19 ConfiguredGrantConfigIndex-r16,

ul-BWP-Id-r19 BWP-Id,

servCellIndex-r19 ServCellIndex

},

…

pucch-Resource-r19 SEQUENCE {

…

resource PUCCH-ResourceId,

ul-BWP-Id-r19 BWP-Id,

pucch-Cell-r19 ENUMERATED {spCell, pucch-Scell}

}

}

It is not clear if the BWP for PUSCH resource is deactivated, whether the UE should transmit an associated PUCCH in an active BWP when there is a UE initiated beam measurement report.

**[Proposed Solution]**:

UE will not transmit a PUCCH for beam measurement report notification in Mode B if the BWP for the associated PUSCH is deactivated.

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution?

If yes, proponents please provide TP in the comment. If not, please provide reasoning and alternative solution/TP.

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | No | From the signaling point of view, this is a valid case. But I guess it’s up to NW implementation to ensure the BWP that provides the second channel CG PUSCH is activated if UE had transmitted the first channel PUCCH. So no spec impact found. Otherwise, it’s hard for UE to determine whether the BWP is activated or not upon the arrival of CG PUSCH because the BWP is dynamically switched by the NW. |
| Ofinno | Yes  Agree with Sharp’s proposal and have an additional proposal | The issue is valid. If the type 1 CG for mode B is configured for a deactivated BWP, the UE does not need to transmit a PUCCH. However, If the UE must wait for the NW to switch back to an activated BWP that is configured with type 1 CG for mode B, this can lead to increased CSI reporting delays or signaling overhead.  In addition to what is proposed by Sharp, when the UE triggers UE-initiated CSI reporting, if a PUCCH resource is configured on a BWP which is not activated, the UE cannot transmit the PUCCH notification, which also degrades the beam management performance. Since the network does not know when the UE will trigger the UE-initiated CSI reporting, the network needs to keep these UL BWP(s) that configured with the PUCCH resource and Type 1 CG PUSCH resource always being activated. Otherwise, the UE needs to wait until both of these uplink BWP(s) are activated to perform UE-initiated CSI reporting, which delays the CSI reporting as well.  Based on the above analysis, we have the following additional proposal:  **Proposal: When UE-initiated CSI reporting is triggered:**   * **If the PUCCH resources and/or the Type 1 CG resources for UE-initiated CSI reporting are not configured in the activated UL BWP, the UE performs BWP switching to an UL BWP where the PUCCH resource and/or the Type 1 CG PUSCH resource are configured.** |
| Sharp | Yes | For clarification to CATT, we think UE should determine if the PUSCH is in an activated UL BWP at the occasion for PUCCH transmission if triggered but not until the occasion for PUSCH transmission. It just like what we do in DRX scenario. |
| ASUSTeK | Yes |  |
| Samsung | Yes | We agree with the proposal. But seems the current MAC is already clear:  Clause 5.15.1:  …  1> if a BWP is deactivated or the Serving Cell is PSCell of deactivated SCG:  2> not transmit on UL-SCH on the BWP;  2> not transmit on RACH on the BWP;  2> not monitor the PDCCH on the BWP;  2> not transmit PUCCH on the BWP;  2> not report CSI for the BWP;  2> not transmit SRS on the BWP;  2> not receive DL-SCH on the BWP;  2> clear any configured downlink assignment and configured uplink grant of configured grant Type 2 on the BWP;  2> suspend any configured uplink grant of configured grant Type 1 on the inactive BWP.  Open to discuss whether any change is needed on top of the current spec. |
| Nokia | No | A smart NW would make sure that BWP with CG PUSCH is activated |

Rapporteur summary:

# [Ofinno] [Issue-3]

**[Issue description]**:

In legacy, in order not to degrade the system performance, the UE can still perform some critical uplink transmissions during FR2 UL gap such as Msg1/Msg3/MsgA, SR**,** LRR**,** UL-SCH for configured grant, ….

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| --- |
| **TS 38.321** 5.30 Handling of FR2 UL gap During the FR2 UL gap configured by *ul-GapFR2-Config* as specified in TS 38.331 [5], the MAC entity shall, on the Serving Cell(s) of FR2 single CC and intra-band CA, or on the Serving Cell(s) of FR2 inter-band CA where UE does not support *tx-Support-UL-GapFR2*:  1> only perform transmission of:  2> PRACH preamble as specified in clause 5.1.2 and 5.1.2a;  2> UL-SCH for Msg3 or the MSGA payload as specified in clause 5.4.2.2;  2> UL-SCH for configured grant;  2> the valid CSI report during SCell activation procedure where the valid CSI report is valid CQI with non-zero CQI index defined in TS 38.214 [7], clause 5.2.2.1, when the time period between UL gap colliding with CSI report of non-zero CQI and the slot where the SCell activation MAC CE or CSI report activation command is received is no less than 10 ms;  2> the valid L1 RSRP report during SCell activation procedure, where the valid L1 RSRP report is non lowest L1 RSRP defined in TS 38.133 [11], clause 10.1.6, when the time period between UL gap colliding with L1 RSRP reporting and the slot where the SCell activation MAC CE or CSI report activation command is received is no less than 10 ms;  2> the PUCCH transmission for SR, and link recovery request (LRR) defined in TS 38.133 [11], clause 8.5. |

According to the RAN1#120 agreement, the first PUCCH carrying a UE-initiated report indication has higher priority than a normal SR.

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| **RAN1#120 Agreement**  On beam report transmission procedure for UE-initiated/event-driven beam reporting, support the following option of dropping rule for the Case-1: the 1-bit first PUCCH is collided/overlapped with a PUCCH carrying normal SR and/or a PUCCH with normal LRR   * Option-1: LRR > **first PUCCH** > normal SR   Note: When the 1-bit first PUCCH is collided/overlapped with a PUCCH carrying normal SR and/or a PUCCH with normal LRR, only one of them is transmitted based on the above priority rule |

The PUCCH used for Mode A UE-initiated CSI reporting serves a function analogous to that of SR and is even assigned a higher priority. This prioritization signifies that the PUCCH associated with UE-initiated CSI reporting is deemed more critical than the SR. Since the normal SR is transmitted during FR2 UL gaps, the UE behavior should also be specified for cases where the higher-priority UE-initiated report indicator in PUCCH overlaps with an FR2 uplink gap. Given that UE-initiated CSI reporting is an important mechanism for maintaining the radio connection, dropping the first PUCCH during an FR2 uplink gap could negatively affect system performance.

For mode B, the type 1 CG PUSCH may fall within the FR2 UL gap. In legacy, the normal CG is transmitted during the FR2 UL gaps. Given that the Type 1 CG for UE-initiated CSI reporting is more important and is a key mechanism for radio connection maintenance, dropping the configured grant PUSCH during the FR2 UL gap could negatively impact system performance. Therefore, the CG type 1 for mode-B UE-initiated CSI reporting should also be transmitted during FR2 UL gaps

**[Proposed Solution]:**

**Solution: During FR2 UL gap, the UE performs:**

**PUCCH transmission for UE Initiated Report Indication; and**

**transmission of CG Type 1 for mode-B UE-initiated CSI reporting.**

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| --- |
| **Text Proposal** 5.30 Handling of FR2 UL gap During the FR2 UL gap configured by *ul-GapFR2-Config* as specified in TS 38.331 [5], the MAC entity shall, on the Serving Cell(s) of FR2 single CC and intra-band CA, or on the Serving Cell(s) of FR2 inter-band CA where UE does not support *tx-Support-UL-GapFR2*:  1> only perform transmission of:  2> PRACH preamble as specified in clause 5.1.2 and 5.1.2a;  2> UL-SCH for Msg3 or the MSGA payload as specified in clause 5.4.2.2;  2> UL-SCH for configured grant;  2> Configured grant Type 1 for mode-B UE-initiated CSI reporting;  2> the valid CSI report during SCell activation procedure where the valid CSI report is valid CQI with non-zero CQI index defined in TS 38.214 [7], clause 5.2.2.1, when the time period between UL gap colliding with CSI report of non-zero CQI and the slot where the SCell activation MAC CE or CSI report activation command is received is no less than 10 ms;  2> the valid L1 RSRP report during SCell activation procedure, where the valid L1 RSRP report is non lowest L1 RSRP defined in TS 38.133 [11], clause 10.1.6, when the time period between UL gap colliding with L1 RSRP reporting and the slot where the SCell activation MAC CE or CSI report activation command is received is no less than 10 ms;  2> the PUCCH transmission for SR, UE Initiated Report Indication, and link recovery request (LRR) defined in TS 38.133 [11], clause 8.5. |

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution?

If yes, please provide comments to the TP if any. If not, please provide reasoning and alternative solution/TP.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Yes | OK with the TP |
| Ofinno | Yes |  |
| Sharp | Yes |  |
| ASUSTeK | Yes but | We wonder if the existing  2> UL-SCH for configured grant;  already covers the Type-1 CG for modeB. |
| Samsung | Yes |  |
| Nokia | Yes |  |

Rapporteur summary:

# [Ofinno] [Issue-4]

**[Issue description]**:

In legacy, the MAC spec defined the handling of the DRX ambiguity period. This is because the UE may not have sufficient processing time for PDCCH/TB decoding to determine whether the active time will be stopped by a DRX MAC CE or extended by PDCCH scheduling new transmission (e.g., to start or restart *drx-inactivityTimer*). To address this issue, a 4 ms ambiguity period was introduced for DRX operation when determining active time for reporting SRS/CSI or not. It was specified that in symbol n, the UE determines active time or not, and consequently whether to report SRS/CSI, by considering grants/assignments/DRX Command MAC CE received, and Scheduling Request sent 4 ms prior to symbol n. This behavior was defined in the MAC spec as highlighted below.

|  |
| --- |
| **TS 38.321** 5.7 Discontinuous Reception (DRX) …  2> if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause; and:  …  3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];  3> not report semi-persistent CSI configured on PUSCH;  3> not report semi-persistent CSI on PUCCH |

RAN2#129bis has agreed:

* In Mode A of UE-initiated CSI reporting, the active time of a DRX operation includes the time after a new UCI for UE-initiated beam reporting is sent on first PUCCH.

This has been specified in the latest CR of TS 38.321 as highlighted below.

|  |
| --- |
| **TS 38.321**  When DRX is configured, the Active Time for Serving Cells in a DRX group includes the time while:  - *…*  - a PDCCH scheduling a mode-A UE-initiated CSI report on PUSCH has not been received after transmitting UE Initiated Report Indication on PUCCH (as specified in TS 38.214 [7]). |

Like the legacy Scheduling Request scenario, the MAC entity is also ambiguous on determining whether the active time will be stopped or extended after transmitting a mode-A UE Initiated Report Indication on PUCCH, because the UE might lack sufficient processing time to decode the PDCCH/TB within the ambiguity period.

**[Proposed Solution]**:

**Solution: The active time ambiguity period of 4ms applies on UE Initiated Report Indication sent for mode-A UE-initiated CSI reporting.**

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| --- |
| **Text Proposal (The same change could be applied to other sections that specified the DRX ambiguity period)** 5.7 Discontinuous Reception (DRX) …  2> if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received, Scheduling Request sent, and UE Initiated Report Indication sent for mode-A UE-initiated CSI reporting until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause; and:  …  3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];  3> not report semi-persistent CSI configured on PUSCH;  3> not report semi-persistent CSI on PUCCH |

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution?

If yes, please provide comments to the TP if any. If not, please provide reasoning and alternative solution/TP.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Yes | OK with the TP |
| Ofinno | Yes |  |
| Sharp | Yes |  |
| ASUSTeK | Yes |  |
| Samsung | Yes |  |
| Nokia | Yes |  |

Rapporteur summary:

# [Ofinno] [Issue-5]

**[Issue description]**:

In Rel-19 asymmetric DL sTRP/UL mTRP scenarios, the UE may transmit repetitions of a PUSCH or PUCCH transmission to both the anchor TRP and the UL-only TRP, or it may perform simultaneous PUSCH/PUCCH transmission using two panels (e.g., via *multipanelSchemeSDM* or *multipanelSchemeSFN*) targeting both TRPs.



In the Rel-19 asymmetric DL sTRP/UL mTRP scheme, a CG/PUSCH for SP-CSI can be associated with both TAGs of both TRPs. However, in the current spec, it’s unclear whether the UE clears the CG/PUSCH for SP-CSI if one or both of the TATs of both TAGs are expired.

For the case that UE is configured with a multi-panel simultaneous uplink transmission SDM scheme (*multipanelSchemeSDM*) for PUSCH, it is possible that some layers of the CG/PUSCH transmissions are mapped to the TCI state associated with a first TAG with expired TAT, while the other layers of the CG/PUSCH transmissions are mapped to the TCI state associated with a second TAG with running TAT. Since one of the two TAGs is not valid, the network may not be able to successfully decode the partial PUSCH transmissions that composed only partial of the layers corresponding to the still-valid TAG. The UE should clear the CG/PUSCH for SP-CSI even if only one of the two TATs of the two TAGs is expired.

**[Proposed Solution]:**

**Solution: when a serving cell is configured with *multipanelSchemeSDM*, the UE should clear any CG/PUSCH for SP-CSI if any of the activated TCI state(s) for the CG/PUSCH for SP-CSI is associated with the TAG of the expired TAT; otherwise, the UE should clear any CG/PUSCH for SP-CSI if all of the activated TCI state(s) for the CG/PUSCH for SP-CSI is associated with the TAG of the expired TAT**

|  |
| --- |
| **Text Proposal**  5.2 Maintenance of Uplink Time Alignment  1> when a *timeAlignmentTimer* expires:  …  3> else if the *timeAlignmentTimer* is associated with a TAG for a Serving Cell configured with two TAGs, and if the *timeAlignmentTimer* associated with the other TAG is running, for all such Serving Cells:  4> clear any configured downlink assignment, if the activated TCI state(s) for all PUCCH resources configured for the configured downlink assignment is associated with the TAG of the expired *timeAlignmentTimer*;  4> if this Serving Cell is configured with *multipanelSchemeSDM*:  5> clear any configured uplink grant, if any of the activated TCI state(s) for the configured uplink grant is associated with the TAG of the expired *timeAlignmentTimer*;  5> clear any PUSCH resource for semi-persistent CSI reporting, if any of the activated TCI state(s) for the PUSCH resource is associated with the TAG of the expired *timeAlignmentTimer*;  4> else:  5> clear any configured uplink grant, if all of the activated TCI state(s) for the configured uplink grant is associated with the TAG of the expired *timeAlignmentTimer*;  5> clear any PUSCH resource for semi-persistent CSI reporting, if all of the activated TCI state(s) for the PUSCH resource is associated with the TAG of the expired *timeAlignmentTimer*;  4> maintain NTA (defined in TS 38.211 [8]) of this TAG. |

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution?

If yes, please provide comments to the TP if any. If not, please provide reasoning and alternative solution/TP.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Yes | Thanks Ofinno for the clarification and sorry for my misunderstanding. After check with my RAN1 colleague, I echo the Ofinno proposal, because for SDM mechanism, the codeword cannot be decoded due to the loss of partial MIMO layers. |
| Ofinno | Yes | Clarification to @CATT’s comment: this issue is not related to UE initiated CSI reporting. This issue is introduced due to the support of the Rel-19 asymmetric DL sTRP/UL mTRP scenario. |
| ASUSTeK | Yes |  |
| Samsung | No | We agree that NW may have issue if only receiving some layers of a TB. We can clarify that UE does not transmit any uplink transmission via multi-panel SDM scheme if any TCI state to be applied for the multi-panel SDM transmission is associated to a TAG for which the TAT is expired.  However, we don’t see any need to clear the CG. The CG can be used once expired TAT is recovered. If only needs to be released if all the activated TCI states are associated to expired TAT(s), which is the current behavior in our understanding.  Regarding the change on the Rel-18 procedure (i.e., adding “all of”), in our understanding “all of” is the intended behavior of the current procedure. If majority think it is not clear in the current procedure, we can consider a Rel-18 CR. |
| Nokia | Comment | We think the issue falls outside the scope of this email discussion (or not specific to only asymmetric DL sTRP/UL mTRP, It is an issue in rel 18 2TA and SMTP as well). |
|  |  |  |

Rapporteur summary:

# [Ofinno] [Issue-6]

**[Issue description]**:

In legacy, when there is a BSR triggered, the UE shall trigger a SR if there is no UL-SCH resource available. In TS 38.321 (as shown below), there is a NOTE highlights that UL-SCH resources are considered available if the MAC entity has an active configured grant.

|  |
| --- |
| **TS 38.321**  5.4.5 Buffer Status Reporting  …  The MAC entity shall:  …  2> if a Regular BSR has been triggered and *logicalChannelSR-DelayTimer* is not running:  3> if there is no UL-SCH resource available for a new transmission; or  3> if the MAC entity is configured with configured uplink grant(s) and the Regular BSR was triggered for a logical channel for which *logicalChannelSR-Mask* is set to *false*; or  3> if the UL-SCH resources available for a new transmission do not meet the LCP mapping restrictions (see clause 5.4.3.1) configured for the logical channel that triggered the BSR:  4> trigger a Scheduling Request.  NOTE 2: UL-SCH resources are considered available if the MAC entity has an active configured grant, or receives, or determines an uplink grant. If the MAC entity has determined at a given point in time that UL-SCH resources are available, this need not imply that UL-SCH resources are available for use at that point in time. |

However, the CG Type 1 for mode-B UE-initiated CSI reporting cannot be used to generate MAC PDU for UL-SCH data, so the MAC entity shall not consider an active CG Type 1 for mode-B UE-initiated CSI reporting as available UL-SCH resources. The MAC entity should be allowed to trigger a SR even if the MAC entity has an active CG Type 1 for mode-B UE-initiated CSI reporting.

**[Proposed Solution]:**

**Solution: CG Type 1 for mode-B UE-initiated CSI reporting should not be used to consider whether UL-SCH resources are available.**

|  |
| --- |
| **Text Proposal (The same change could be applied to other sections that specified the same NOTE)**  5.4.5 Buffer Status Reporting  …  The MAC entity shall:  …  2> if a Regular BSR has been triggered and *logicalChannelSR-DelayTimer* is not running:  3> if there is no UL-SCH resource available for a new transmission; or  3> if the MAC entity is configured with configured uplink grant(s) and the Regular BSR was triggered for a logical channel for which *logicalChannelSR-Mask* is set to *false*; or  3> if the UL-SCH resources available for a new transmission do not meet the LCP mapping restrictions (see clause 5.4.3.1) configured for the logical channel that triggered the BSR:  4> trigger a Scheduling Request.  NOTE 2: UL-SCH resources are considered available if the MAC entity has an active configured grant (except for configured grant Type 1 for mode-B UE-initiated CSI reporting (configured in *pusch-ResourceOfModeB-r19*)), or receives, or determines an uplink grant. If the MAC entity has determined at a given point in time that UL-SCH resources are available, this need not imply that UL-SCH resources are available for use at that point in time. |

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution?

If yes, please provide comments to the TP if any. If not, please provide reasoning and alternative solution/TP.

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| **Company** | **Yes/No** | **Comments** |
| CATT | Yes | OK with the TP for clarification. |
| Ofinno | Yes |  |
| Sharp | Yes |  |
| ASUSTeK | No strong view | The current running CR indicates that the MAC entity shall not use mode B CG to generate MAC PDU, so the MAC should not consider the CG as available:  The MAC entity shall not use the configured grant Type 1 for mode-B UE-initiated CSI reporting (configred in *pusch-ResourceOfModeB-r19*) to generate MAC PDU for UL-SCH data transmission in the procedures specified in this clause and in clause 5.4.  But we can follow majority if clarification is considered beneficial. |
| Samsung | No | Share the same comment as ASUSTek that the current MAC has already made it clear that mode-B CG is not used for UL-SCH data transmission. |
| Nokia | No | Same view as ASUSTeK and Samsung |

Rapporteur summary:

# [Samsung] [Issue-7]

**[Issue description]**:

For mode-A UEI-CSI reporting, CSI trigger state indication in DCI is used as similar to AP-CSI reporting. RAN1 made following agreements on this.

**Agreement RAN1#118bis**

On beam report transmission procedure for UE-initiated/event-driven beam reporting, regarding the triggering procedure in Step-2 of Mode-A

* Reuse CSI request field in DCI format 0\_1/0\_2 to trigger the transmission of the UEI beam report
  + If a CSI trigger state associated with UEI beam report configuration(s) is indicated by the CSI request field in DCI format 0\_1/0\_2, the UE transmits the corresponding UEI beam report(s) in the second PUSCH scheduled by the DCI format 0\_1/0\_2
  + FFS: DCI format 0\_3
* FFS: Whether a CSI trigger state should be dedicated to UE-initiated/event-driven beam reporting, i.e., not associated with legacy AP-CSI report configuration.

**Agreement RAN1#119**

On beam report transmission procedure for UE-initiated/event-driven beam reporting, regarding the triggering procedure in Step-2 of Mode-A, down-select one of the following options in RAN1#120

* Option-1: A CSI trigger state is dedicated to UE-initiated/event-driven beam reporting, i.e., not associated with legacy AP-CSI report configuration.
* Option-2: A CSI trigger state can be associated with
  + only UE-initiated/event-driven beam reporting
  + or only legacy AP-CSI configuration
  + or UE-initiated/event-driven beam reporting and legacy AP-CSI configuration

**Agreement RAN1#120**

On beam report transmission procedure for UE-initiated/event-driven beam reporting, regarding the triggering procedure in Step-2 of Mode-A, the following Option-1 is supported.

* Option-1: A CSI trigger state corresponding to UE-initiated/event-driven beam reporting can NOT be associated with legacy AP-CSI report configuration.

Based on the above agreement, the existing CSI request field in DCI for AP-CSI reporting is reused for UEI-CSI reporting and the existing mechanism for CSI trigger state is applied, but the CSI trigger state for UEI reporting is dedicated for UEI-CSI report, not shared with AP-CSI report.

For the CSI trigger state, reportTriggerSize/reportTriggerSizeDCI-0-2 is used to configure the bit size of CSI request field in DCI (bits) (see TS 38.214 [19], clause 5.2.1.5.1). If the number of configured CSI trigger states (at most 128) is larger than the number of codepoints (at most 64) that can be indicated by the CSI request field, Aperiodic CSI Trigger State Subselection MAC CE is used to indicate a subselection of the configured CSI trigger states (see TS 38.321 clause clause 6.1.3.13).

For UEI-CSI reporting, since the existing mechanism for CSI trigger state for AP-CSI reporting is reused, the existing MAC CE should also be used for CSI trigger state subselection for UEI-CSI reporting. However, the currently the MAC CE is only applied for AP-CSI trigger state as specified in MAC. The term “CSI trigger state” should be used (same as in RAN1 spec.) to include the cases of both AP-CSI and UEI-CSI.

**[Proposed Solution]**:

Proposal: The existing Aperiodic CSI Trigger State Subselection MAC CE is used for CSI trigger state subselection for UEI-CSI reporting. Discuss how to update the description relevant to Aperiodic CSI Trigger State Subselection MAC CE, consider the TP below.

5.18.3 Aperiodic CSI Trigger State Subselection

The network may select among the configured CSI trigger states of a Serving Cell for aperiodic CSI or mode-A UE-initiated CSI by sending the Aperiodic CSI Trigger State Subselection MAC CE described in clause 6.1.3.13.

The MAC entity shall:

1> if the MAC entity receives an Aperiodic CSI trigger State Subselection MAC CE on a Serving Cell:

2> indicate to lower layers the information regarding Aperiodic CSI trigger State Subselection MAC CE.

6.1.3.13 Aperiodic CSI Trigger State Subselection MAC CE

The Aperiodic CSI Trigger State Subselection MAC CE is identified by a MAC subheader with LCID as specified in Table 6.2.1-1. It has a variable size consisting of following fields:

- Serving Cell ID: This field indicates the identity of the Serving Cell for which the MAC CE applies. The length of the field is 5 bits;

- BWP ID: This field indicates a DL BWP for which the MAC CE applies as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9]. The length of the BWP ID field is 2 bits;

- Ti: This field indicates the selection status of the CSI Trigger States configured within *aperiodicTriggerStateList*, as specified in TS 38.331 [5]. T0 refers to the first trigger state within the list, T1 to the second one and so on. If the list does not contain entry with index i, MAC entity shall ignore the Ti field. The Ti field is set to 1 to indicate that the CSI Trigger State i shall be mapped to the codepoint of the DCI *CSI request* field, as specified in TS 38.214 [7]. The codepoint to which the CSI Trigger State is mapped is determined by its ordinal position among all the CSI Trigger States with Ti field set to 1, i.e. the first CSI Trigger State with Ti field set to 1 shall be mapped to the codepoint value 1, second CSI Trigger State with Ti field set to 1 shall be mapped to the codepoint value 2 and so on. The maximum number of mapped CSI Trigger States is 63;

- R: Reserved bit, set to 0.

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution?

If yes, please provide comments to the TP if any. If not, please provide reasoning and alternative solution/TP.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Yes | OK with the TP |
| Ofinno | Yes | OK with the TP |
| Sharp | Yes |  |
| ASUSTeK | Yes | The RRC description for aperiodicTriggerStateList should also be updated accordingly. |
| Samsung | Yes |  |
| Nokia | Yes |  |

Rapporteur summary:

# [Samsung] [Issue-8]

**[Issue description]**:

RAN2 has agreed for mode-A PUSCH the existing rule of handling overlapping/prioritization is used and no MAC impact. However, it is not clear how to handle mode-B CG PUSCH in case of overlapping with another CG PUSCH. The current rule in clause 5.4.1 is “If the MAC entity is configured with *lch-basedPrioritization* and if there is overlapping PUSCH duration of at least two configured uplink grants whose priorities are equal, the prioritized uplink grant is determined by UE implementation. If the MAC entity is not configured with *lch-basedPrioritization* and if there is overlapping PUSCH duration of at least two configured uplink grants, it is up to UE implementation to choose one of the configured uplink grants.”. Need to discuss how to handle mode-B CG when overlapping with another CG if *lch-basedPrioritization* is not configured. If *lch-basedPrioritization* is configured, the priority should not be applied to the mode-B CG since it is not used for UL-SCH transmission, then how to handle mode-B CG when overlapping with another CG with priority.

**[Proposed Solution]**:

Proposal 1: If *lch-basedPrioritization* is configured, the priority should not be applied to the mode-B CG since it is not used for UL-SCH transmission. Clarify in MAC.

Proposal 2: If *lch-basedPrioritization* is not configured, discuss how to handle mode-B CG when overlapping with another CG.

Option-1: apply the current rule (i.e., leave to UE implementation), no MAC impact.

Option-2: prioritize mode-B CG for UEI-CSI reporting (update the note in MAC)

Option-3: prioritize the other overlapping CG (update the note in MAC)

Proposal 3: If *lch-basedPrioritization* is configured, discuss how to handle mode-B CG when overlapping with another CG with priority. (update the note in MAC)

Option-1: apply the current rule (i.e., leave to UE implementation)

Option-2: prioritize mode-B CG for UEI-CSI reporting

Option-3: prioritize the other overlapping CG

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution? Which option do you agree?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **P1: Yes/No** | **P2: Option 1/2/3** | **P3: Option 1/2/3** | **Comments** |
| CATT | Yes | Option-2 | Option-1 |  |
| Ofinno | Yes | Option-4: excluding the mode-B CG in overlapping handling | Option-4: excluding the mode-B CG in overlapping handling | The *lch-basedPrioritization* is a data-based prioritization at MAC level based on the actual data availability when a resource arrives, which is used by MAC to generate a MAC PDU for the prioritized resource.  **P1:** Since the mode-B CG is not used for generating a MAC PDU, this priority should not be applied to the mode-B CG. The PHY-based prioritization mechanism will handle the resource conflict between CG PUSCH and CG PUSCH.  **P2:** Since the mode-B CG is not used for generating a MAC PDU, the mode-B CG should be excluded from overlapping handling in MAC level. The PHY-based prioritization mechanism will handle the resource conflict between CG PUSCH and CG PUSCH.  Suggested TP for P2 (Option-4):  NOTE 7: If the MAC entity is not configured with *lch-basedPrioritization* and if there is overlapping PUSCH duration of at least two configured uplink grants (excluding configured grant Type 1 for mode-B UE-initiated CSI reporting (configured in *pusch-ResourceOfModeB-r19*)), it is up to UE implementation to choose one of the configured uplink grants.  **P3:** Same comment as P2.  Suggested TP for P3 (Option-4):  NOTE 6: If the MAC entity is configured with *lch-basedPrioritization* and if there is overlapping PUSCH duration of at least two configured uplink grants (excluding configured grant Type 1 for mode-B UE-initiated CSI reporting (configured in *pusch-ResourceOfModeB-r19*)) whose priorities are equal, the prioritized uplink grant is determined by UE implementation. |
| Sharp | Yes | Option-2 | Option-1 |  |
| ASUSTeK | See comments | - | - | With the clarification added in 5.8.2:  The MAC entity shall not use the configured grant Type 1 for mode-B UE-initiated CSI reporting (configred in *pusch-ResourceOfModeB-r19*) to generate MAC PDU for UL-SCH data transmission in the procedures specified in this clause and in clause 5.4.  The CG is simply not used in 5.4 and should not be involved in prioritization in MAC. TP for clarification may not be needed. |
| Samsung | See comment |  |  | We are fine not to consider mode-B CG in MAC overlapping handling since it is not used for UL-SCH data transmission.  We can make a clarification agreement on this, e.g., for UEI reporting, MAC does not consider overlapping handling for 1) mode-A/B PUCCH resource overlapping with other resources and 2) mode-B PUSCH resource overlapping with other resources.  If majority think it is already clear, we are fine not to make any changes. |
| Nokia | No |  |  | Same view as ASUSTeK |

Rapporteur summary:

# [Samsung] [Issue-9]

**[Issue description]**:

For cell DRX, RAN1 has specified that UE do UCI multiplexing first without considering cell DRX and transmits the PUCCH/PUSCH during non-active period if HARQ-ACK is multiplexed in the PUCCH/PUSCH.

|  |
| --- |
| TS 38.213  After resolving the overlapping for PUCCH and/or PUSCH transmissions, and if cell DRX is activated for a serving cell and a PUCCH or PUSCH transmission would overlap with the non-active period of cell DRX of the serving cell, the UE does not transmit the PUCCH if HARQ-ACK information is not multiplexed in the PUCCH, or does not transmit the PUSCH if HARQ-ACK information is not multiplexed in the PUSCH and the PUSCH is not associated with a corresponding PDCCH, respectively. |

In the current MAC procedure, UEI reporting PUCCH/PUSCH is not transmitted in non-active time regardless of HARA-ACK.

**[Proposed Solution]**:

Exclude the case of HARQ-ACK multiplexed on PUCCH/PUSCH in clause 5.34.3.

1> if cell DRX is activated and the Serving Cell is not in the cell DRX Active Period:

2> not instruct the physical layer to signal a SR on a PUCCH resource for SR;

2> not increment the *SR\_COUNTER* for a SR;

2> not start the *sr-ProhibitTimer* for a SR;

2> not deliver any configured uplink grant and the associated HARQ information to the HARQ entity;

2> not instruct a HARQ process associated with a configured uplink grant to trigger a new transmission or a retransmission;

2> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH;

2> not transmit UE Initiated Report Indication on PUCCH of the Serving Cell for mode-A UE-initiated CSI reporting if HARQ-ACK information is not multiplexed in the PUCCH;

2> not transmit UE Initiated Report Indication on PUCCH and the associated mode-B UE-initiated CSI report on PUSCH if the PUCCH or the PUSCH resource of the Serving Cell is not in the cell DRX Active Period and if HARQ-ACK information is not multiplexed in the PUCCH or the PUSCH;

2> if an emergency service is initiated by upper layers and this Serving Cell is the SpCell:

3> initiate a Random Access procedure (as specified in clause 5.1.1).

NOTE 2: How the MAC layer in the UE is aware of an ongoing emergency service is up to UE implementation.

2> if upper layers provide Access Identity 1 or Access Identity 2 and this Serving Cell is the SpCell:

3> initiate a Random Access procedure (as specified in clause 5.1.1).

#### **[Phase-2 Discussion]:**

Do you agree with the proposed solution?

If yes, please provide comments to the TP if any. If not, please provide reasoning and alternative solution/TP.

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| **Company** | **Yes/No** | **Comments** |
| Nokia | yes | Ok with the TP |
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# Conclusions

The following open issues are listed with suggested way forward.

…

# References

1. R2-2506202 Report from session on Rel-18 MIMO, Rel-19 MIMO, LPWUS, SBFD, NR Others RAN2 Vice Chairman (CATT)
2. R2-2506539 Rel-19 TS 38.321 CR#2100 Samsung