**3GPP TSG RAN WG1 #109-e R1-220xxxx**

**e-Meeting, May 9th – 20th, 2022**

**Agenda item:** 8.1.2

**Source:** Moderator (vivo)

**Title:** Feature lead Summary [109-e-R17-MIMO-03] Maintenance on multi-TRP inter-cell

**Document for:** Discussion and Decision

1. Introduction

Following email thread is assigned for email discussion on maintenance of intercell mTRP, please provide your comments in corresponding sections below

[109-e-R17-MIMO-03] Maintenance on multi-TRP inter-cell (description of issues in R1-220XXXX) by May 18 – Rakesh (vivo)

* Issues #1, #4, #5 and #8
* Issues #2 and #3
* Issue #6
* Issue #7 (no further discussion in next meeting if no consensus in this meeting)

1. Discussion

**Issues#1, #4, #5, #8:**

Following 4 issues are proposed for discussion,

* **Issue#1**

TPs for 38.213 in sections 9.2.6, 11.1, 11.1.1:

*ServingCellConfigCommon* or, if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*, by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH

* **Issue#4**

TPs for 38.214 in sections 9.2.6, 11.1, 11.1.1

to a UE by *ssb-PositionsInBurst* in *SIB1* or *ssb-PositionsInBurst* in *ServingCellConfigCommon* or, if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*, by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI*~~associated to physical cell ID with active TCI states~~.

* **Issue#5**

TP for 38.214 in Section 6.1.2.1

--Unchanged part omitted------------------------

For PUSCH repetition Type B, the UE determines invalid symbol(s) for PUSCH repetition Type B transmission as follows:

- A symbol that is indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* is considered as an invalid symbol for PUSCH repetition Type B transmission.

- For operation in unpaired spectrum, symbols indicated by *ssb-PositionsInBurst* in SIB1, or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* for reception of SS/PBCH blocks are considered as invalid symbols for PUSCH repetition Type B transmission.

- For a reduced capability half-duplex UE in paired spectrum and for PUSCH repetition Type B transmission, symbols indicated by *ssb-PositionsInBurst* in SIB1, or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* for reception of SS/PBCH blocks are considered as invalid symbols for PUSCH repetition Type B transmission.

--Unchanged part omitted----------------

- If the UE

- is configured with multiple serving cells within a cell group and is provided with *directionalCollisionHandling-r16* = 'enabled' for a set of serving cell(s) among the multiple serving cells, and

- indicates support of *half-DuplexTDD-CA-SameSCS-r16* capability, and

- is not configured to monitor PDCCH for detection of DCI format 2-0 on any of the multiple serving cells,

- a symbol indicated to the UE for reception of SS/PBCH blocks in a first cell of the multiple serving cells by *ssb-PositionsInBurst* in *SIB1,* or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* is considered as an invalid symbol for PUSCH repetition Type B transmission in

- any of the multiple serving cells if the UE is not capable of simultaneous transmission and reception as indicated by *simultaneousRxTxInterBandCA* among the multiple serving cells, and

- any one of the cells corresponding to the same band as the first cell, irrespective of any capability indicated by *simultaneousRxTxInterBandCA*

--Unchanged part omitted-------------------

* **Issue#8:** related TP on this proposal can be discussed together with above TPs

Clarify that the following Rel-15/16 based procedures consider SSBs with a serving cell PCI or SSBs with an active additional PCI – a) UE does not expect the set of SSB symbols to be indicated as uplink symbols (38.213, Section 11.1 and Section 11.1.1), b) such SSB symbols are assumed to be invalid symbols in a nominal repetition for Type B PUSCH (38.214, Section 6.1.2.1), c) a slot is not counted towards repetition if PUCCH resource in that slot overlaps with an SSB (38.213, Section 9.2.6).

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| Company | comments |
| ZTE | First, the description of the SSB of the active additional PCI in issue #4, #5, and #8 should be consistent to the following agreement in RAN1#108-e meeting.  **Agreement**  For inter-cell mTRP, UE does not transmit PUCCH/PUSCH/PRACH in a slot or SRS in the symbols if in time domain the PUCCH/PUSCH/PRACH/SRS overlaps with an SSB of a serving cell PCI or an SSB associated with the active additional PCI.  Second, the clarification of active TCI states for PDSCH/PDCCH of the active additional PCI is needed for #4, #5 and #8 according to the following agreement in RAN1#106-e meeting.  **Agreement**   * For inter-cell mTRP, one PCI associated with one or more of activated TCI states for PDSCH/PDCCH is associated with one CORESETPoolIndex, another PCI associated with one or more of activated TCI states for PDSCH/PDCCH is associated with another CORESETPoolIndex   FFS: The association between PCI and CORESETPoolIndex when switching between intra-cell mTRP and inter-cell mTRP  Third, given that the part “if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*,” is being discussed in AI 8.1.1, it is proper to put in brackets of this part at the current stage.  In the light of the above, we propose the following updates of these TPs:  Updated TPs:   * **Issue#1**   TPs for 38.213 in sections 9.2.6, 11.1, 11.1.1:  *ServingCellConfigCommon* or, [if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*,] by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH   * **Issue#4**   TPs for 38.214 in sections 9.2.6, 11.1, 11.1.1  to a UE by *ssb-PositionsInBurst* in *SIB1* or *ssb-PositionsInBurst* in *ServingCellConfigCommon* or, [if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*,] by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH~~associated to physical cell ID with active TCI states~~.   * **Issue#5**   TP for 38.214 in Section 6.1.2.1  --Unchanged part omitted------------------------  For PUSCH repetition Type B, the UE determines invalid symbol(s) for PUSCH repetition Type B transmission as follows:  - A symbol that is indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* is considered as an invalid symbol for PUSCH repetition Type B transmission.  - For operation in unpaired spectrum, symbols indicated by *ssb-PositionsInBurst* in SIB1, or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH for reception of SS/PBCH blocks are considered as invalid symbols for PUSCH repetition Type B transmission.  - For a reduced capability half-duplex UE in paired spectrum and for PUSCH repetition Type B transmission, symbols indicated by *ssb-PositionsInBurst* in SIB1, or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH for reception of SS/PBCH blocks are considered as invalid symbols for PUSCH repetition Type B transmission.  --Unchanged part omitted----------------  - If the UE  - is configured with multiple serving cells within a cell group and is provided with *directionalCollisionHandling-r16* = 'enabled' for a set of serving cell(s) among the multiple serving cells, and  - indicates support of *half-DuplexTDD-CA-SameSCS-r16* capability, and  - is not configured to monitor PDCCH for detection of DCI format 2-0 on any of the multiple serving cells,  - a symbol indicated to the UE for reception of SS/PBCH blocks in a first cell of the multiple serving cells by *ssb-PositionsInBurst* in *SIB1,* or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH is considered as an invalid symbol for PUSCH repetition Type B transmission in  - any of the multiple serving cells if the UE is not capable of simultaneous transmission and reception as indicated by *simultaneousRxTxInterBandCA* among the multiple serving cells, and  - any one of the cells corresponding to the same band as the first cell, irrespective of any capability indicated by *simultaneousRxTxInterBandCA*  --Unchanged part omitted------------------- |
| Apple | For issue #1, we think CSI-RS should be added since CSI-RS can be the source for spatialRelationInfo.  *ServingCellConfigCommon* or, if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*, by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH or CSI-RS  Proposal in issue #4 is not aligned with agreement.  Proposal in issue #5 is optimization, which is not necessary and seems to have been discussed in UL coverage enhancement agenda but not agreed.  Proposal in issue #8 is covered by issue #1, #4, and #5. No need to do anything additional. |
| QC | Support TPs under issue #4 and #5.  In our understanding, “active PCI” in the previous agreement is not well-defined.  If we define this as PCI associated with active TCI states for PDSCH/PDCCH, then it will be problematic as UE still measures SSBs from the PCIs not associated with the active TCI state, and cannot transmit any UL signal/channel if overlaps with the measured SSBs. To address the issue, we can either define “SSBs measured by UE” or remove the condition “associated to physical cell ID with active TCI states”. The former may not be very straightforward as multiple configurations may need to be checked. Furthermore, in practice, when additional PCIs are configured, irrespective of whether they are associated with the active PCIs or not, network will configure measurements for the UE. Otherwise, network cannot know which beam should be activated for the UE. Hence, our preference is the latter option, i.e., remove the condition “associated to physical cell ID with active TCI states”. |
| NTT DOCOMO | OK with TP for issue#1.  For issue#4 and #5, we prefer ZTE’s updated TP. |
| LG | Support TP for issue #1, which is aligned with the agreement.  Proposal in issue #4 reverts the previous agreement.  Issue #5 is optimization and we fail to find critical problem. According to current specification, PUSCH transmission is just omitted if it collides with SSB by ssb-PositionsInBurst in SSB-MTCAdditionalPCI associated to physical cell ID with active TCI states. |
| Intel | TP#1 is okay. for TP#4 and TP#5 we also think that active PCI is sufficient |
| OPPO | We are fine with TP#1.  For TP#4, we prefer ZTE’s version which is consistent with the agreement.  For TP#5, we think it is not needed and further agreement is needed. |
| Nokia, NSB | TP#1 m: we do not think it is needed. It should be clear that mTRP does not support unified TCI and UL does not have such notion for inter-cell multi-TRP.  TP#4: OK  TP#5: OK  Issue #8: does not seem necessary. |
| Samsung | We are OK for TP#1 – the discussions were confined to inter-cell multi-TRP, not sure why putting brackets on “not indicated/provided unified TCI states” is needed.  TPs #5 and #8 seem not needed. |

**Issues#2, #3**

Following 2 issues are proposed for discussion,

* **Issue#2**

3 alternatives TP proposal for 38.214 in section 5.1.4 are addressing same issue with different wordings.

Alt. 1:

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, and the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block associated with the same PCI is transmitted.

Alt. 2:

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted. When the UE is configured with [*NumberOfAdditionalPCI*] and is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*, if the PDSCH resource allocation overlaps with PRBs containing a candidate SS/PBCH block corresponding to a SS/PBCH block index provided by *ssb-PositionsInBurst* in *SSB-MTC-AdditionalPCI-r17* with same physical cell identity as the one associated with a RS having same quasi-collocation properties as the PDSCH, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.

<Unchanged text omitted>

Alt. 3:

--Unchanged part omitted------------------------

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, and the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted. If PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources according to *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* with same physical cell identity as the one associated with a RS having same quasi-collocation properties as the PDSCH, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.

A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH*.*

* **Issue#3**

TP for38.214 in section 5.1.6.2:

**5.1.6.2 DM-RS reception procedure**

**< Unchanged parts are omitted >**

If the UE receives the DM-RS for PDSCH and an SS/PBCH block associated with the same PCI in the same OFDM symbol(s), then the UE may assume that the DM-RS and SS/PBCH block are quasi co-located with ‘typeD’, if ‘typeD’ is applicable. Furthermore, the UE shall not expect to receive DM-RS in resource elements that overlap with those of the SS/PBCH block associated with the same PCI as the DM-RS, and the UE can expect that the same or different subcarrier spacing is configured for the DM-RS and SS/PBCH block in a CC except for the case of 240 kHz where only different subcarrier spacing is supported. A DMRS for PDSCH is said to be associated with an additional PCI if the activated TCI states for the PDSCH is associated with the additional PCI; otherwise, DMRS for PDSCH is associated with serving cell PCI.

**< Unchanged parts are omitted >**

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| Company | comments |
| ZTE | For issue#3, we agree with its TP.  For issue#2, we propose the following updated TP to keep alignment with issue#3 and which is simpler and clearer compared with Alt 1-3.  Updated TP of issue#2:  When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, and the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block associated with the same PCI is transmitted. The PDSCH is to be associated with an additional PCI if the activated TCI states for the PDSCH is associated with the additional PCI; otherwise, PDSCH is associated with serving cell PCI. |
| Apple | For TP in issue #3, we suggest either deleting the last sentence or changing it as follows :  A DMRS for PDSCH is said to be associated with an additional PCI if the indicated TCI state for the PDSCH is associated with the additional PCI; otherwise, DMRS for PDSCH is associated with serving cell PCI.  Issue #2 is under discussion in 8.1.1. We do not think we need to agree any TP in 8.1.2.2. |
| QC | For all issues, we are fine to align the TPs and use similar language. The suggestion from ZTE above seems fine to us. |
| NTT DOCOMO | For issue#2 and issue#3, we share similar view as ZTE. |
| LG | We are fine with the suggestion from ZTE and revised wording suggested by Apple. |
| Intel | For Issue#3 we have the same views as Apple. For Issue #2 we are okay in principle with the ZTE version |
| OPPO | We are fine with the modification from Apple and ZTE. |
| Nokia, NSb | Issue #2: ok with ZTE version.  Issue #3: ok with the TP. |
| Samsung | Issue #2: ZTE’s version may include measurement SSBs, which is under discussion in 8.1.1 maintenance  Issue #3: the last sentence is for clarification – no “additional PCI”, “serving cell PCI” exist in previous contents, so we think below version should be enough:  A DMRS for PDSCH is said to be associated with a~~n additional~~ PCI if the activated TCI states for the PDSCH is associated with the ~~additional~~ PCI~~; otherwise, DMRS for PDSCH is associated with serving cell PCI~~. |

**Issue#6**

TP for 38.214 in section 5.1.5 is proposed for discussion,

5.1.5 Antenna ports quasi co-location

[…]

For a periodic CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*, the UE shall expect that a TCI-State indicates one of the following quasi co-location type(s):

- ‘typeC’ with an SS/PBCH block and, when applicable, ‘typeD’ with the same SS/PBCH block, or

- ‘typeC’ with an SS/PBCH block and, when applicable,’typeD’ with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*~~.~~ , or

- ‘typeC’ with an SS/PBCH block and, when applicable, ‘typeD’ with the same SS/PBCH block, the reference RS may additionally be an SS/PBCH block having a PCI different from the PCI of the serving cell. The UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell.

[…]

For a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* and without the higher layer parameter *repetition*, the UE shall expect that a TCI-State indicates one of the following quasi co-location type(s):

- ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with the same CSI-RS resource, or

- ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with an SS/PBCH block, or

- ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or

- ‘typeB’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* when ‘typeD’ is not applicable~~.~~ , or

- ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with an SS/PBCH block, the reference RS may additionally be an SS/PBCH block having a PCI different from the PCI of the serving cell. The UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell.

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| Company | comments |
| ZTE | We tend to agree with this TP in principle, except for the restriction that same center frequency, SCS, SFN offset is applied to one serving cell rather than across serving cells with additional PCIs. It is intuitive that “the serving cell” includes all serving cells and it refers a type of cell instead of a exact serving cell. For example, the center frequency, SCS, SFN offset of SSB of serving cell 1 do not need to be same as SSB of additional PCI of serving cell 2. Hence we propose the following updated TP.  Updated TP:  TP for 38.214 in section 5.1.5 is proposed for discussion,  5.1.5 Antenna ports quasi co-location  […]  For a periodic CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*, the UE shall expect that a TCI-State indicates one of the following quasi co-location type(s):  - ‘typeC’ with an SS/PBCH block and, when applicable, ‘typeD’ with the same SS/PBCH block, or  - ‘typeC’ with an SS/PBCH block and, when applicable,’typeD’ with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*~~.~~ , or  - ‘typeC’ with an SS/PBCH block and, when applicable, ‘typeD’ with the same SS/PBCH block, the reference RS may be an additional SS/PBCH block having a PCI different from the PCI of the serving cell. For one serving cell, the UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell.  […]  For a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* and without the higher layer parameter *repetition*, the UE shall expect that a TCI-State indicates one of the following quasi co-location type(s):  - ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with the same CSI-RS resource, or  - ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with an SS/PBCH block, or  - ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or  - ‘typeB’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* when ‘typeD’ is not applicable~~.~~ , or  - ‘typeA’ with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, ‘typeD’ with an SS/PBCH block, the reference RS may be an additional SS/PBCH block having a PCI different from the PCI of the serving cell. For one serving cell, the UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell. |
| Apple | This is under discussion in 8.1.1. We do not think we need to agree any TP in 8.1.2.2. |
| QC | Ok with the TP. |
| NTT DOCOMO | Support the TP. |
| LG | Support the TP. |
| Intel | Support |
| OPPO | Support the TP in principle. |
| Nokia, NSB | Support |
| Samsung | Similar view to Apple. |

**Issue#7**

Following is proposed for discussion,

* + - For each cell with additional PCI, LTE CRS pattern for rate matching can be configured by RRC signaling.

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| Company | comments |
| ZTE | Support this proposal.  Technically, per TRP LTE CRS pattern for rate matching is the same to the enhancement of SSB related rate matching in MTRP inter-cell operation, hence we fail to see the logic to preclude per TRP LTE CRS pattern for rate matching. Meanwhile, given that per TRP LTE CRS pattern was supported for MDCI based MTRP operation in Rel-17, this fundamental feature should be inherited to guarantee the performance of Rel-18 MTRP inter-cell operation as well. Otherwise, this issue will cause too much restriction of NW scheduling, i.e., RRC reconfiguration of LTE-CRS rate matching pattern is mandatory when considering the PCI of one CORESET pool index is updated by MAC-CE, which extremely impact the flexibility of NW scheduling. |
| Apple | Support the proposal since R17 supports up to 7 additional cells. |
| QC | Do not support this proposal. DSS-specific optimizations are non-essential at this stage for Rel-17. This can be discussed as part of Rel-18 DSS or Rel-18 TEI if needed.  It is noted that even in Rel-16 multi-DCI based mTRP, the main/initial agreement related to multiple LTE CRS patterns was not decided in MIMO, but it was agreed in other Ais specifically discussing DSS (and in was during the Rel-16 WI not during maintenance). |
| NTT DOCOMO | Support the proposal. Agree with ZTE. |
| LG | We have similar view with QC. |
| OPPO | We have the same view with QC. |
| Nokia, NSB | Support. Similar view as ZTE |
| Samsung | Similar view to QC. |

1. Outcome of pre-phase discussion

The issues are summarized in the following table:

**Table 1 Summary**

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| **#** | **Issue (summary of CR proposal)** | **Companies** | **FL assessment** | **Company inputs (if any)** |
| 1 | In 38.213 sections 9.2.6, 11.1, 11.1.1, following TP is proposed:  *ServingCellConfigCommon* or, if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*, by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDSCH or PDCCH  ([R1-2203259](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip))  FL: Propose to discuss the text proposal | ZTE | H  [comments from companies are aligned, and proposed to discuss #1, #4, #5 and #8 together] | Apple: We agree this issue needs to be discussed, since the definition of active TCI states are unclear. We think issue #1, 4 and 8 can be discussed together.  QC: Agree with H. We suggest discussing issues #1, #4, #5, #8 together. The meaning of “active” needs to be clarified taking into account the SSBs used for L1-RSRP measurements.  ZTE: Agree with FL’s assessment. We also agree to discuss issues #1, #4, #5 and #8 together.  OPPO: Agree with H and discuss issue 1,4,5,8 together.  LGE: Agree with FL’s assessment.  DOCOMO: Agree with H and discuss issue 1,4,5,8 together.  Spreadtrum: Support to discuss #1, 4, 5, 8 together  CATT: Support to discuss #1,4,5,8 together  Intel: Agree to discuss #1,4,5,8 together  SS: OK to discuss #1,4,5,8 together. But instead of discussing one by one, we suggest to formulate the common issue out of these items. From our understanding, the common issue is to clarify “active TCI for PCI other than the serving cell PCI”  Lenovo: Agree with H and discuss issue 1,4,5,8 together. |
| 2 | Following 3 alternatives are proposed to for PDSCH rate matching.  Alt. 1: TP for 38.214, section 5.1.4,  When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, and the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block associated with the same PCI is transmitted.  ([R1-2203](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)506)  Alt. 2: TP for 38.214, section 5.1.4,  When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted. When the UE is configured with [*NumberOfAdditionalPCI*] and is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*, if the PDSCH resource allocation overlaps with PRBs containing a candidate SS/PBCH block corresponding to a SS/PBCH block index provided by *ssb-PositionsInBurst* in *SSB-MTC-AdditionalPCI-r17* with same physical cell identity as the one associated with a RS having same quasi-collocation properties as the PDSCH, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.  <Unchanged text omitted>  ([R1-2203](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)856)  Alt. 3: TP for 38.214, section 5.1.4,  --Unchanged part omitted------------------------  When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, and the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted. If PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources according to *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* with same physical cell identity as the one associated with a RS having same quasi-collocation properties as the PDSCH, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.  A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH*.*  ([R1-220](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)4977)  FL: agreement on PDSCH rate matching is not yet captured in 38.214, proposed to discuss the text proposals, exact wording is for further discussion | vivo, Samsung, Qualcomm | H  [  H: 9  N: 1  Proposed to discuss #2 and #3 together  ] | Apple: This seems to be non-essential.  QC: This is obviously essential as the agreement is not captured yet. Support to discuss as H.  ZTE: Agree with FL’s assessment.  OPPO: Support the TP. It is a similar issue as issue 3. Maybe they can be discussed together.  Ericsson: H  LGE: Agree with FL’s assessment.  DOCOMO: Agree with H. It can be discussed with issue 3 together.  Spreadtrum: Agree with H. Regarding the FFS in below agreement, we have no related agreement. Discussion is needed.  Agreement  Agree on scheme1   * Scheme1: PDSCH/PDCCH from non-serving cell (PCI) associated with TCI state and/or QCL-info is rate matched around non-serving cell SSB with the same PCI * FFS: whether PDSCH /PDCCH from serving cell (PCI) is rate matched around non-serving cell SSB * FFS: whether PDSCH/PDCCH from non-serving cell (PCI) associated with TCI state and/or QCL-info is rate matched around serving cell SSB   CATT: support to discuss #2, 3 together  Intel: same view as CATT, discuss #2, 3 together  SS: This is based on an earlier agreement, which should be captured in 214.  Lenovo: Support FL’s assessment. |
| 3 | In 38.214, following TP is proposed:  **5.1.6.2 DM-RS reception procedure**  …  If the UE receives the DM-RS for PDSCH and an SS/PBCH block associated with the same PCI in the same OFDM symbol(s), then the UE may assume that the DM-RS and SS/PBCH block are quasi co-located with 'typeD', if 'typeD' is applicable. Furthermore, the UE shall not expect to receive DM-RS in resource elements that overlap with those of the SS/PBCH block associated with the same PCI as the DM-RS, and the UE can expect that the same or different subcarrier spacing is configured for the DM-RS and SS/PBCH block in a CC except for the case of 240 kHz where only different subcarrier spacing is supported. A DMRS for PDSCH is said to be associated with an additional PCI if the activated TCI states for the PDSCH is associated with the additional PCI; otherwise, DMRS for PDSCH is associated with serving cell PCI.  **< Unchanged parts are omitted >**  ([R1-2203](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)949)  FL: propose to discuss the text proposal | OPPO | H  [  H: 8  N: 1  Propossed to discuss #2 and #3  together  ] | Apple: We do not think this is necessary.  QC: Support to discuss as H.  ZTE: Agree with FL’s assessment.  OPPO: Support to discuss. Similar wording can be applied to issue 2 and 3, and maybe they can be discussed together. Without this TP, serving cell PDSCH cannot be transmitted in symbol with neighboring cell SSB  LGE: Agree with FL’s assessment.  DOCOMO: Agree with H. It can be discussed with issue 2 together.  Spreadtrum: Agree with H, can be discussed together with issue 2.  CATT: support to discuss as H  Lenovo: Support FL’s assessment. |
| 4 | In 38.214, TP for sections 9.2.6, 11.1, 11.1.1  to a UE by *ssb-PositionsInBurst* in *SIB1* or *ssb-PositionsInBurst* in *ServingCellConfigCommon* or, if the UE is not provided *DLorJoint-TCIState* or *followUnifiedTCIstate*, by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI*~~associated to physical cell ID with active TCI states~~.  ([R1-220](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)4977)  FL: propose to discuss the text proposal | Qualcomm | H  [Proposed to discuss #1, #4, #5 and #8 together] | Apple: We think issue #1, 4 and 8 can be discussed together.  QC: Support to discuss as H. As mentioned above, we suggest discussing issues #1, #4, #5, #8 together.  ZTE: Discuss issues #1, #4, #5 and #8 together.  OPPO: Support to discuss issue 1,4,5,8 together.  LGE: Discuss issues #1, #4, #5 and #8 together.  DOCOMO: Discuss issues #1, #4, #5 and #8 together.  Spreadtrum: Support to discuss #1, 4, 5, 8 together  CATT: Support to discuss #1,4,5,8 together |
| 5 | =======TP for 38.214 Section 6.1.2.1 =====  --Unchanged part omitted------------------------  For PUSCH repetition Type B, the UE determines invalid symbol(s) for PUSCH repetition Type B transmission as follows:  - A symbol that is indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* is considered as an invalid symbol for PUSCH repetition Type B transmission.  - For operation in unpaired spectrum, symbols indicated by *ssb-PositionsInBurst* in SIB1, or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* for reception of SS/PBCH blocks are considered as invalid symbols for PUSCH repetition Type B transmission.  - For a reduced capability half-duplex UE in paired spectrum and for PUSCH repetition Type B transmission, symbols indicated by *ssb-PositionsInBurst* in SIB1, or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* for reception of SS/PBCH blocks are considered as invalid symbols for PUSCH repetition Type B transmission.  --Unchanged part omitted----------------  - If the UE  - is configured with multiple serving cells within a cell group and is provided with *directionalCollisionHandling-r16* = 'enabled' for a set of serving cell(s) among the multiple serving cells, and  - indicates support of *half-DuplexTDD-CA-SameSCS-r16* capability, and  - is not configured to monitor PDCCH for detection of DCI format 2-0 on any of the multiple serving cells,  - a symbol indicated to the UE for reception of SS/PBCH blocks in a first cell of the multiple serving cells by *ssb-PositionsInBurst* in *SIB1,* or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, or by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* is considered as an invalid symbol for PUSCH repetition Type B transmission in  - any of the multiple serving cells if the UE is not capable of simultaneous transmission and reception as indicated by *simultaneousRxTxInterBandCA* among the multiple serving cells, and  - any one of the cells corresponding to the same band as the first cell, irrespective of any capability indicated by *simultaneousRxTxInterBandCA*  --Unchanged part omitted-------------------  ([R1-220](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)4977)  FL: propose to discuss the text proposal | Qualcomm | H  [Proposed to discuss #1, #4, #5 and #8 together] | Apple: This seems to be non-essential.  QC: Support to discuss as H. As mentioned above, we suggest discussing issues #1, #4, #5, #8 together.  ZTE: Discuss issues #1, #4, #5 and #8 together.  OPPO: Support to discuss issue 1,4,5,8 together.  LGE: Discuss issues #1, #4, #5 and #8 together.  DOCOMO: Discuss issues #1, #4, #5 and #8 together.  Spreadtrum: Support to discuss #1, 4, 5, 8 together  CATT: Support to discuss #1,4,5,8 together  Intel: CATT: Support to discuss #1,4,5,8 together  Lenovo: Support to discuss #1,4,5,8 together |
| 6 | Corresponding TP for 5.1.5 is also proposed   * + ***Specify QCL source RS of the TRS and CSI-RS for CSI can be SSB with PCI different from serving cell for M-TRP inter-cell in TS38.214.***   ([R1-220](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)4336)  FL: This issue has been discussed in past meetings, it can be further discussed in this meeting, and conclude in this meeting. | NTT DOCOMO | [Companies can indicate H or N]  [  H: 10  N: 0  Proposed for discussion  ] | Apple: OK to discuss  QC: The issue seems valid, and may be different than the previous discussions. In current spec, only CSI-RS for BM can have SSB with PCI different from serving cell PCI as QCL source RS. In our understanding, there is no agreement for the existing restriction in the spec.  ZTE: Support to discuss this issue as H.  OPPO: Support to discuss as H.  LGE: Support to discuss as H.  DOCOMO: H.  Spreadtrum: fine to discuss  CATT: Support to discuss  Intel: Good to discuss  Lenovo: OK to discuss. |
| 7 | * + ***For each cell with additional PCI, LTE CRS pattern for rate matching can be configured by RRC signaling.***   ([R1-220](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)4336)  FL: This issue has been discussed in past meetings, it can be further discussed in this meeting, and conclude in this meeting. | NTT DOCOMO | [Companies can indicate H or N]  [  H: 5  N: 4  Proposed to discuss in this meeting, no further discussion in next meeting if no consensus in this meeting  ] | Apple: OK to discuss  QC: This is N. It has been discussed multiple times before. Optimizations for DSS use case in this AI at this stage is not needed.  ZTE: Support to discuss this issue as H. It is very critical to ease the complexity of UE implementation (similar as X1 and X2 were introduced for non-serving cell SSB related rate matching) and avoid too much restriction of gNB schedule (i.e. RRC reconfiguration of LTE-CRS rate matching pattern is needed when considering the PCI of one CORESET pool index is updated by MAC-CE). Btw, we fail to see logic that this issue is relevant to the optimization of DSS as QC commented before.  OPPO: We can discuss this issue, but with lower priority.  LGE: N. we have the same view with QC.  DOCOMO: H.  Ericsson: H. We don’t see the argument why DSS should be excluded from inter-cell mTRP? Why does the operator have to choose between these two features?  Spreadtrum: fine to discuss  CATT: Support to discuss  Lenovo: Share similar view with QC. |
| 8 | ***Clarify that the following Rel-15/16 based procedures consider SSBs with a serving cell PCI or SSBs with an active additional PCI – a) UE does not expect the set of SSB symbols to be indicated as uplink symbols (38.213, Section 11.1 and Section 11.1.1), b) such SSB symbols are assumed to be invalid symbols in a nominal repetition for Type B PUSCH (38.214, Section 6.1.2.1), c) a slot is not counted towards repetition if PUCCH resource in that slot overlaps with an SSB (38.213, Section 9.2.6).***  ([R1-220](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip)4764)  FL: in RAN1#108-e, it was agreed that UE does not transmit PUCCH/PUSCH/PRACH in a slot or SRS in the symbols if in time domain the PUCCH/PUSCH/PRACH/SRS overlaps with an SSB of a serving cell PCI or an SSB associated with the active additional PCI. Whether the proposed clarification is needed or not can be discussed, and conclude in this meeting. | Intel | [Companies can indicate H or N]  [Propose to discuss #1, #4, #5 and #8 together] | Apple: We think issue #1, 4 and 8 can be discussed together.  QC: For a) and c), this is already captured by the spec (some discussions on “active” is needed as in Issue 1 and 4). For b), this is same as issue 5.  ZTE: Agree with QC’s elaboration and suggest to discuss issues #1, #4, #5 and #8 together.  OPPO: Support to discuss issue 1,4,5,8 together.  LGE: Discuss issues #1, #4, #5 and #8 together.  DOCOMO: Discuss issues #1, #4, #5 and #8 together.  Spreadtrum: Support to discuss #1, 4, 5, 8 together  CATT: Support to discuss #1,4,5,8 together  Intel: Support to discuss #1,4,5,8 together  Lenovo: Support to discuss #1,4,5,8 together. |
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1. Observations from pre-phase discussion

From the inputs shared by participating companies during the preparation phase, the following **observation** can be made:

* Almost all companies agree to discuss #1, #4, #5 and #8 together
* Vast majority of companies agree to discuss #2 and #3, few companies proposed to discuss them together
* All companies agree to discuss #6
* Views are split on #7, almost half/half on necessity to discuss.

FL proposal: in this meeting

* Discuss #1, #4, #5 and #8 together
* Discuss #2 and #3 together
* Discuss #6
* Discuss #7 and no further discussion in next meeting if no consensus in this meeting

# References

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| 1 | [R1-2203259](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203259.zip) | Remaining issues on multi-TRP deployment | ZTE |
| 2 | R1-2203506 | Maintenance on enhancements for multi-TRP Deployment | vivo |
| 3 | [R1-2203856](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203856.zip) | Maintenance on Rel-17 multi-TRP and HST-SFN | Samsung |
| 4 | [R1-2203949](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203949.zip) | Maintenance on enhancements for mTRP deployment | OPPO |
| 5 | [R1-2204336](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204336.zip) | Remaining issues on enhancements for Multi-TRP Deployment | NTT DOCOMO, INC. |
| 6 | R1-2204764 | MIMO Enhancements for Multi-TRP Deployment | Intel Corporation |
| 7 | [R1-2204977](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204977.zip) | Remaining Details for Multi-TRP Operation | Qualcomm Incorporated |