**3GPP TSG RAN WG1 Meeting #106-e R1-210xxxx**

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

Source: Moderator (CATT)

Title: Summary of [106-e-NR-eMIMO-01]

Agenda Item: 7.2.6

Document for: Discussion and Decision

# Introduction

Maintenance-related issues raised in the submitted contributions for Rel.16 NR\_eMIMO maintenance are summarized in [1]. Based on discussions during the preparation phase, some editorial correction issues (MB.4, MT.2, MT.6, MU.1, O.1, O.2 combined) have been identified for further discussion.

In this contribution, the discussion for the following email thread is summarized:

[106-e-NR-eMIMO-01] Editorial corrections (MB.4, MT.2, MT.6, MU.1, O.1, O.2 combined) for recommendation for the editors by August 20 – Xin (CATT)

# MB.4

In [2], it’s proposed to clarify that for SCell candidate beam detection, UE should indicate whether it identifies one new beam instead of one new beam from CSI-RS and another one new beam from SSB. The following text proposal for TS38.213 is provided in [2]:

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| --- |
| 6 Link recovery procedures <unchanged part omitted>  For the PCell or the PSCell, upon request from higher layers, the UE provides to higher layers the periodic CSI-RS configuration indexes and/or SS/PBCH block indexes from the set  and the corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold.  For the SCell, upon request from higher layers, the UE indicates to higher layers whether there is at least one periodic CSI-RS configuration index or SS/PBCH block index from the set  with corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, and provides the periodic CSI-RS configuration indexes and/or SS/PBCH block indexes from the set  and the corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, if any.  <unchanged part omitted> |

Please share your views in the following table:

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| --- | --- |
| **Company** | **Comment** |
| CATT | Support the CR. |
| Samsung | Support |
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# MT.2

In [3], it’s proposed to correct a typo in 5.1.6.1.1 of 38.214:

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| --- |
| 5.1.6.1.1 CSI-RS for tracking <unchanged part omitted>  -Periodic CSI-RS resource in one set and aperiodic CSI-RS resources in a second set, with the aperiodic CSI-RS and periodic CSI-RS resource having the same bandwidth (with same RB location) and the aperiodic CSI-RS being configured with *qcl-Type* set to ‘ typeA’ and 'typeD', where applicable, with the periodic CSI-RS resources.  <unchanged part omitted> |

Please share your views in the following table:

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| **Company** | **Comment** |
| CATT | Support the CR. |
| Samsung | Support |
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# MT.6

In [4], it’s proposed to align RRC parameter between 38.331 and 38.213, i.e. revise RRC parameter “ACKNackFeedbackMode = JointFeedback” to “ackNackFeedbackMode = joint”:

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| --- |
| 9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel < Unchanged parts are omitted >  - if, for an active DL BWP of a serving cell, the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode = joint,* the serving cell is counted two times where the first time corresponds to the first CORESETs and the second time corresponds to the second CORESETs  < Unchanged parts are omitted > |

Please share your views in the following table:

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| **Company** | **Comment** |
| CATT | Support the CR. |
| Samsung | Support |
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# MU.1

In [5], it’s proposed to clarify that PMI component i1,2 may not be reported. The following text proposal is provided for 5.2.3 of 38.214 in [5]:

|  |  |  |  |  |  |  |  |  |
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| 5.2.3 CSI reporting using PUSCH A UE shall perform aperiodic CSI reporting using PUSCH on serving cell c upon successful decoding of a DCI format 0\_1 or DCI format 0\_2 which triggers an aperiodic CSI trigger state.  When a DCI format 0\_1 schedules two PUSCH allocations, the aperiodic CSI report is carried on the second scheduled PUSCH. When a DCI format 0\_1 schedules more than two PUSCH allocations, the aperiodic CSI report is carried on the penultimate scheduled PUSCH.  An aperiodic CSI report carried on the PUSCH supports wideband, and sub-band frequency granularities. An aperiodic CSI report carried on the PUSCH supports Type I, Type II and Enhanced Type II CSI.  A UE shall perform semi-persistent CSI reporting on the PUSCH upon successful decoding of a DCI format 0\_1 or DCI format 0\_2 which activates a semi-persistent CSI trigger state. DCI format 0\_1 and DCI format 0\_2 contains a CSI request field which indicates the semi-persistent CSI trigger state to activate or deactivate. Semi-persistent CSI reporting on the PUSCH supports Type I, Type II with wideband, and sub-band frequency granularities and Enhanced Type II CSI. The PUSCH resources and MCS shall be allocated semi-persistently by an uplink DCI.  CSI reporting on PUSCH can be multiplexed with uplink data on PUSCH except that semi-persistent CSI reporting on PUSCH activated by a DCI format is not expected to be multiplexed with uplink data on the PUSCH. CSI reporting on PUSCH can also be performed without any multiplexing with uplink data from the UE.  Type I CSI feedback is supported for CSI Reporting on PUSCH. Type I wideband and sub-band CSI is supported for CSI Reporting on the PUSCH. Type II CSI is supported for CSI Reporting on the PUSCH.  For Type I, Type II and Enhanced Type II CSI feedback on PUSCH, a CSI report comprises of two parts. Part 1 has a fixed payload size and is used to identify the number of information bits in Part 2. Part 1 shall be transmitted in its entirety before Part 2.  - For Type I CSI feedback, Part 1 contains RI (if reported), CRI (if reported), CQI for the first codeword (if reported). Part 2 contains PMI (if reported) and contains the CQI for the second codeword (if reported) when RI (if reported) is larger than 4.  - For Type II CSI feedback, Part 1 contains RI (if reported), CQI, and an indication of the number of non-zero wideband amplitude coefficients per layer for the Type II CSI (see Clause 5.2.2.2.3). The fields of Part 1 – RI (if reported), CQI, and the indication of the number of non-zero wideband amplitude coefficients for each layer – are separately encoded. Part 2 contains the PMI of the Type II CSI. Part 1 and 2 are separately encoded.  - For Enhanced Type II CSI feedback, Part 1 contains RI, CQI, and an indication of the overall number of non-zero amplitude coefficients across layers for the Enhanced Type II CSI (see Clause 5.2.2.2.5). The fields of Part 1 – RI, CQI, and the indication of the overall number of non-zero amplitude coefficients across layers – are separately encoded. Part 2 contains the PMI of the Enhanced Type II CSI. Part 1 and 2 are separately encoded.  A Type II CSI report that is carried on the PUSCH shall be computed independently from any Type II CSI report that is carried on the PUCCH formats 3 or 4 (see Clause 5.2.4 and 5.2.2).  When the higher layer parameter *reportQuantity* is configured with one of the values 'cri-RSRP', 'ssb-Index-RSRP', 'cri-SINR' or 'ssb-Index-SINR', the CSI feedback consists of a single part.  For both Type I and Type II reports configured for PUCCH but transmitted on PUSCH, the determination of the payload for CSI part 1 and CSI part 2 follows that of PUCCH as described in Clause 5.2.4.  When CSI reporting on PUSCH comprises two parts, the UE may omit a portion of the Part 2 CSI. Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1, where  is the number of CSI reports configured to be carried on the PUSCH. Priority 0 is the highest priority and priority  is the lowest priority and the CSI report *n* corresponds to the CSI report with the *n*th smallest Prii,CSI(*y,k,c,s*) value among the  CSI reports as defined in Clause 5.2.5. The subbands for a given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in increasing order with the lowest subband of *csi-ReportingBand* as subband 0. When omitting Part 2 CSI information for a particular priority level, the UE shall omit all of the information at that priority level.  - For Enhanced Type II reports, for a given CSI report , each reported element of indices and , indexed by and , is associated with a priority value , with with , , and , and where is defined in Clause 5.2.2.2.5. The element with the highest priority has the lowest associated value . Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1, where  - Group 0 includes indices , (if reported) and ().  - Group 1 includes indices (if reported), (if reported), the highest priority elements of , , the highest priority elements of and the highest priority elements of ().  - Group 2 includes the lowest priority elements of , the lowest priority elements of and the lowest priority elements of ().  Table 5.2.3-1: Priority reporting levels for Part 2 CSI   |  | | --- | | Priority 0:  For CSI reports 1 to , Group 0 CSI for CSI reports configured as 'typeII-r16' or 'typeII-PortSelection-r16'; Part 2 wideband CSI for CSI reports configured otherwise | | Priority 1:  Group 1 CSI for CSI report 1, if configured as 'typeII-r16' or 'typeII-PortSelection-r16'; Part 2 subband CSI of even subbands for CSI report 1, if configured otherwise | | Priority 2:  Group 2 CSI for CSI report 1, if configured as 'typeII-r16' or 'typeII-PortSelection-r16'; Part 2 subband CSI of odd subbands for CSI report 1, if configured otherwise | | Priority 3:  Group 1 CSI for CSI report 2, if configured as 'typeII-r16' or 'typeII-PortSelection-r16'; Part 2 subband CSI of even subbands for CSI report 2, if configured otherwise | | Priority 4:  Group 2 CSI for CSI report 2, if configured as 'typeII-r16' or 'typeII-PortSelection-r16'. Part 2 subband CSI of odd subbands for CSI report 2, if configured otherwise | | ⁞ | | Priority :  Group 1 CSI for CSI report , if configured as 'typeII-r16' or 'typeII-PortSelection-r16'; Part 2 subband CSI of even subbands for CSI report , if configured otherwise | | Priority :  Group 2 CSI for CSI report , if configured as 'typeII-r16' or 'typeII-PortSelection-r16'; Part 2 subband CSI of odd subbands for CSI report , if configured otherwise |   < Unchanged parts are omitted > |

Please share your views in the following table:

|  |  |
| --- | --- |
| **Company** | **Comment** |
| CATT | Support the CR. |
| Samsung | Support |
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# O.1

In [6], it’s claimed that the description “*if the qcl-Type is set to 'typeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol*” is unclear and not aligned with agreement in RAN1#92 (stating irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH). The following text proposal for 5.1.5 of 38.214 is provided in [6]:

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| 5.1.5 Antenna ports quasi co-location The UE can be configured with a list of up to *M* *TCI-State* configurations within the higher layer parameter *PDSCH-Config* to decode PDSCH according to a detected PDCCH with DCI intended for the UE and the given serving cell, where M depends on the UE capability *maxNumberConfiguredTCIstatesPerCC*. Each *TCI-State* contains parameters for configuring a quasi co-location relationship between one or two downlink reference signals and the DM-RS ports of the PDSCH, the DM-RS port of PDCCH or the CSI-RS port(s) of a CSI-RS resource. The quasi co-location relationship is configured by the higher layer parameter *qcl-Type1* for the first DL RS, and *qcl-Type2* for the second DL RS(if configured). For the case of two DL RSs, the QCL types shall not be the same, regardless of whether the references are to the same DL RS or different DL RSs. The quasi co-location types corresponding to each DL RS are given by the higher layer parameter *qcl-Type* in *QCL-Info* and may take one of the following values:  - 'typeA': {Doppler shift, Doppler spread, average delay, delay spread}  - 'typeB': {Doppler shift, Doppler spread}  - 'typeC': {Doppler shift, average delay}  - 'typeD': {Spatial Rx parameter}  The UE receives an activation command, as described in clause 6.1.3.14 of [10, TS 38.321], used to map up to 8 TCI states to the codepoints of the DCI field *'Transmission Configuration Indication'* in one CC/DL BWP or in a set of CCs/DL BWPs, respectively. When a set of TCI state IDs are activated for a set of CCs/DL BWPs, where the applicable list of CCs is determined by indicated CC in the activation command, the same set of TCI state IDs are applied for all DL BWPs in the indicated CCs.  When a UE supports two TCI states in a codepoint of the DCI field '*Transmission Configuration Indication'* the UE may receive an activation command, as described in clause 6.1.3.24 of [10, TS 38.321], the activation command is used to map up to 8 combinations of one or two TCI states to the codepoints of the DCI field *'Transmission Configuration Indication'*. The UE is not expected to receive more than 8 TCI states in the activation command.  When the DCI field *'Transmission Configuration Indication'* is present in DCI format 1\_2 and when the number of codepoints S in the DCI field *'Transmission Configuration Indication'* of DCI format 1\_2 is smaller than the number of TCI codepoints that are activated by the activation command, as described in clause 6.1.3.14 and 6.1.3.24 of [10, TS38.321], only the first S activated codepoints are applied for DCI format 1\_2.  When the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the activation command, the indicated mapping between TCI states and codepoints of the DCI field *'Transmission Configuration Indication'* should be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH. If *tci-PresentInDCI* is set to 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET scheduling the PDSCH, and the time offset between the reception of the DL DCI and the corresponding PDSCH is equal to or greater than *timeDurationForQCL* if applicable, after a UE receives an initial higher layer configuration of TCI states and before reception of the activation command, the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the SS/PBCH block determined in the initial access procedure with respect to *qcl-Type* set to 'typeA', and when applicable, also with respect to *qcl-Type* set to 'typeD'.  If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled'for the CORESET scheduling the PDSCH, the UE assumes that the TCI field is present in the DCI format 1\_1 of the PDCCH transmitted on the CORESET. If a UE is configured with the higher layer parameter *tci-PresentDCI-1-2* for the CORESET scheduling the PDSCH, the UE assumes that the TCI field with a DCI field size indicated by *tci-PresentDCI-1-2* is present in the DCI format 1\_2 of the PDCCH transmitted on the CORESET. If the PDSCH is scheduled by a DCI format not having the TCI field present, and the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable, where the threshold is based on reported UE capability [13, TS 38.306], for determining PDSCH antenna port quasi co-location, the UE assumes that the TCI state or the QCL assumption for the PDSCH is identical to the TCI state or QCL assumption whichever is applied for the CORESET used for the PDCCH transmission within the active BWP of the serving cell.  If the PDSCH is scheduled by a DCI format having the TCI field present, the TCI field in DCI in the scheduling component carrier points to the activated TCI states in the scheduled component carrier or DL BWP, the UE shall use the *TCI-State* according to the value of the '*Transmission Configuration Indication*' field in the detected PDCCH with DCI for determining PDSCH antenna port quasi co-location. The UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) in the TCI state with respect to the QCL type parameter(s) given by the indicated TCI state if the time offset between the reception of the DL DCI and the corresponding PDSCH is equal to or greater than a threshold *timeDurationForQCL*, where the threshold is based on reported UE capability [13, TS 38.306]. When the UE is configured with a single slot PDSCH, the indicated TCI state should be based on the activated TCI states in the slot with the scheduled PDSCH. When the UE is configured with a multi-slot PDSCH, the indicated TCI state should be based on the activated TCI states in the first slot with the scheduled PDSCH, and UE shall expect the activated TCI states are the same across the slots with the scheduled PDSCH. When the UE is configured with CORESET associated with a search space set for cross-carrier scheduling and the UE is not configured with *enableDefaultBeamForCCS*, the UE expects *tci-PresentInDCI* is set as 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET, and if one or more of the TCI states configured for the serving cell scheduled by the search space set contains *qcl-Type* set to 'typeD', the UE expects the time offset between the reception of the detected PDCCH in the search space set and the corresponding PDSCH is larger than or equal to the threshold *timeDurationForQCL.*  Independent of the configuration of *tci-PresentInDCI* and *tci-PresentDCI-1-2* in RRC connected mode, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains *qcl-Type* set to 'typeD',  - the UE may assume that the DM-RS ports of PDSCH(s) of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE. In this case, if the 'QCL-TypeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers).  - If a UE is configured with *enableDefaultTCI-StatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,*  - the UE may assume that the DM-RS ports of PDSCH associated with a value of *coresetPoolIndex* of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH, in the latest slot in which one or more CORESETs associated with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH within the active BWP of the serving cell are monitored by the UE. In this case, if the 'QCL-TypeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol and they are associated with same value of *coresetPoolIndex*, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers).  - If a UE is configured with enableTwoDefaultTCI-States, and at least one TCI codepoint indicates two TCI states, the UE may assume that the DM-RS ports of PDSCH or PDSCH transmission occasions of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) associated with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states. When the UE is configured by higher layer parameter repetitionScheme set to 'tdmSchemeA' or is configured with higher layer parameter repetitionNumber, and the offset between the reception of the DL DCI and the first PDSCH transmission occasion is less than the threshold timeDurationForQCL, the mapping of the TCI states to PDSCH transmission occasions is determined according to clause 5.1.2.1 by replacing the indicated TCI states with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the 'QCL-TypeD' in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states is different from that of the PDCCH DM-RS with which they overlap in at least one symbol, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers)  If none of configured TCI states for the serving cell of scheduled PDSCH is configured with qcl-Type set to 'typeD', the UE shall obtain the other QCL assumptions from the indicated TCI state(s) for its scheduled PDSCH irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH.  If the PDCCH carrying the scheduling DCI is received on one component carrier, and the PDSCH scheduled by that DCI is on another component carrier:  - The *timeDurationForQCL* is determined based on the subcarrier spacing of the scheduled PDSCH. If µPDCCH < µPDSCH an additional timing delay is added to the *timeDurationForQCL*, where *d* is defined in 5.2.1.5.1a-1, otherwise *d* is zero;  - For both the cases, when the UE is configured with *enableDefaultBeamForCCS*, and when the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL,* and when the DL DCI does not have the TCI field present, the UE obtains its QCL assumption for the scheduled PDSCH from the activated TCI state with the lowest ID applicable to PDSCH in the active BWP of the scheduled cell.  < Unchanged parts are omitted > |

Please share your views in the following table:

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| **Company** | **Comment** |
| CATT | Support the CR to make spec clearer. |
| Samsung | We are fine for the first modification.  Regarding the second one, the case when the scheduling offset is equal to or greater than *timeDurationForQCL* is already captured in the current spec regardless of the condition whether all configured TCI states do not contain QCL-TypeD or not. |
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# O.2

In [7], it’s proposed to remove the placeholder in the table 7.4.1.1.2-4 in TS 38.211, where new values are introduced in Rel-16. The following text proposal is provided for 38.211 in [7]:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 7.4.1.1.2 Mapping to physical resources < Unchanged parts are omitted >  Table 7.4.1.1.2-4: PDSCH DM-RS positions  for double-symbol DM-RS.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **in symbols** | **DM-RS positions** | | | | | | | **PDSCH mapping type A** | | | **PDSCH mapping type B** | | | | ***dmrs-AdditionalPosition*** | | | ***dmrs-AdditionalPosition*** | | | | ***pos0*** | ***pos1*** | ***pos2*** | ***pos0*** | ***pos1*** | ***pos2*** | | <4 |  |  |  | - | - |  | | 4 |  |  |  | - | - |  | | 5 |  |  |  |  |  |  | | 6 |  |  |  |  |  |  | | 7 |  |  |  |  |  |  | | 8 |  |  |  |  |  |  | | 9 |  |  |  |  |  |  | | 10 |  | , 8 |  |  |  |  | | 11 |  | , 8 |  |  |  |  | | 12 |  | , 8 |  |  |  |  | | 13 |  | , 10 |  |  |  |  | | 14 |  | , 10 |  | - | - |  |   < Unchanged parts are omitted > |

Please share your views in the following table:

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| --- | --- |
| **Company** | **Comment** |
| CATT | Support the CR. |
| Samsung | Support |
|  |  |
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# Conclusions

TBD

# References

[1] R1-2106863, Summary for Rel.16 NR eMIMO maintenance, moderator (Samsung).

[2] R1-2107717, Apple, Draft CR on SCell candidate beam detection.

[3] R1-2106934, CATT, Correction on QCL-type set for aperiodic CSI-RS.

[4] R1-2107011, ZTE, Sanechips, Correction on the RRC parameter of ackNackFeedbackMode.

[5] R1-2106933, CATT, Correction on MU-CSI enhancement.

[6] R1-2106470, Huawei, HiSilicon, Correction on QCL acquisition in TS 38.214.

[7] R1-2106471, Huawei, HiSilicon, Correction on DM-RS position in TS 38.211.