**3GPP TSG RAN WG1 Meeting #114 R1-230xxxx**

**Toulouse, France, August 21st – 25th, 2023**

**Agenda item: 9.17**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Summary of email discussion on NR\_MIMO enhancements on CSI**

**Document for: Discussion and Decision**

# 1 Introduction

This thread will discuss the draft CR to 38.214 for NR MIMO CSI.

First checkpoint for this discussion: **September 5, 6:00am UTC!**

# 2 Discussion – first round

The comments in this section are based on version 0 of the the draft CR available in the **Post RAN1#114 discussion.**

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| Company | Comments | Editor reply/Notes |
| CATT | **Comment 1(TypeII Doppler):**For the following new added text, it’s better to clarify the value of$ K\_{p}$.

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| For a *CSI-ReportConfig* configured with *codebookType* set to 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18', the UE reports a CSI report only if receiving at least one aperiodic or $K\_{p}$ periodic or semipersistent consecutive CSI-RS transmission occasions for each CSI-RS resource in the corresponding CSI-RS Resource Set for channel measurement and/or one CSI-IM occasion for interference measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise. The value of $K\_{p}\in \{1,2,4\}$ is indicated by UE capability. |

**Comment 2(CJT):**There is no agreement to restrict the value of restrictedCMR-Selection when NTRP=1, so we suggest to add related text according to the following agreement.**Agreement**For the Rel-18 Type-II codebook refinement for CJT mTRP, support ……* if NTRP =1, that the NTRP-bit bitmap (for dynamic TRP selection) is not reported

**Proposed change:**

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| The UE may be configured with higher layer parameter *restrictedCMR-Selection*. If *restrictedCMR-Selection* is configured, the number of selected CSI-RS resources is $N=N\_{TRP}$. Otherwise, the UE is expected to select $N$ CSI-RS resources, with $1\leq N\leq N\_{TRP}$, and the selection is reported with an $N\_{TRP}$-bit bitmap, $b\_{N\_{TRP}}, …,b\_{1}$, where the CSI-RS resources are mapped from bit $b\_{1}$ to bit $b\_{N\_{TRP}}$ by their ordering in the resource set and the first of the $N$ selected CSI-RS resources corresponds to the nonzero bit with lowest index. If NTRP=1, the $N\_{TRP}$-bit bitmap is not reported. |

**Comment 3(TypeII Doppler):**According to the following agreement, only *N4*=1 is supported for the refinement of the Rel-17 FeType-II port seletion codebook. Therefore, relevant text of the Rel-17 FeType-II port seletion codebook with *N4*>1 should be removed.

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| AgreementThe Rel-18 Type-II codebook refinement for high/medium velocities comprises refinement of the following codebooks:* Refinement of the Rel-16 eType-II regular codebook, with N4>=1
* Refinement of the Rel-17 FeType-II port selection (PS) codebook, based on the common design with the Refinement of the Rel-16 eType-II regular codebook, except for the supported set of parameter combinations, with N4=1
	+ Time-/Doppler-domain reciprocity is not assumed
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**Proposed change:**

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| - For Enhanced Type II for predicted PMI with $N\_{4}>1$ (see Clause 5.2.2.2.10), Part 1 contains RI (if reported), the CQI (if the higher layer parameter *TDCQI* is set to '1-1' or '1-2') or the first CQI (if the higher layer parameter *TDCQI* is set to '2') and the total number of reported non-zero amplitude coefficients across layers. The fields of Part 1 – RI (if reported), CQI, and the total number of reported non-zero amplitude coefficients across layers – are separately encoded. Part 2 contains the second CQI (if the higher layer parameter *TDCQI* is set to '2') and the PMI of the Enhanced Type II for predicted PMI ~~or Further Enhanced Type II Port Selection for predicted PMI~~. Part 1 and 2 are separately encoded. |

**Comment 4(TypeII Doppler):**According to the following agreement, the support of *l = (n – nCSI,ref )* is UE optional. Therefore, the relevant description should be added to 5.2.1.4.2 in 38.214.

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| **Agreement**On the CSI reporting and measurement for the Rel-18 Type-II codebook refinement for high/medium velocities, when UE-side prediction is assumed, support UE “predicting” channel/CSI after slot *l* where the location of slot *l* is configured (from multiple candidate values) by gNB via higher-layer signalling* Candidates of slot *l* location include the legacy CSI reference resource location (*n* – *nCSI,ref* ) and slot (*n*+*δ*) where *δ* ≥ 0
* FFS: Possible value(s) of *δ* and possible value(s) of WCSI

Note: Per legacy behavior, the legacy CSI reference resource, i.e., (*n* – *nCSI,ref* ), is reused for locating the last CSI-RS occasion used for a CSI reportFor a UE that supports UE-side prediction, the support of *l* = (*n* – *nCSI,ref* ) is UE optional |

**Proposed change:**

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| Subject to UE capability, a UE configured with a *CSI-ReportConfig* with the higher layer parameter *N4* and *reportQuantity* set to 'cri-RI-PMI-CQI' is assumed to support UE-side CSI prediction. The reported PMI indicates predicted precoder matrices associated with $N\_{4}$ consecutive slot intervals, each with duration of $d$ slots, where the value of $N\_{4}\in \{1,2,4,8\}$ is configured by *N4*. If the UE is configured with an aperiodic CSI-RS resource set for channel measurement, the value, in number of slots, of the time unit $d\in \{1,m\}$ is configured by higher layer parameter *d*, where $m$ is defined in Clause 5.2.1.4.1. If the UE is configured with a periodic or semi-persistent CSI-RS resource set for channel measurement, the value of $d$ is equal to the periodicity of the CSI-RS resource. The earliest of the $N\_{4}$ slot intervals starts at slot $l=n+δ$, where $n$ is the uplink slot in which the CSI is reported and the slot offset $δ$ is configured by higher layer parameter *delta* and $δ\in \{-n\_{CSI\\_ref},0,1,2\}$ with $n\_{CSI\\_ref}$ defined in Clause 5.2.2.5. The value $δ=-n\_{CSI\\_ref}$ can be configured subject to UE capability.- For $N\_{4}=1$, the UE is expected to report a predicted PMI for slot interval $[l,l+d-1]$, ~~where the initial slot~~ $l$ ~~is configured by the slot offset~~ $δ\in \{-n\_{CSI\\_ref},0,1,2\}$ ~~and~~ the value $δ=-n\_{CSI\\_ref}$ can be configured only for $d>1$. A UE can be configured with $N\_{4}=1$ if the higher layer parameter *codebookType* is set to 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18'.- The reported CQI is associated with slot $l$ and the reported PMI.- For $N\_{4}>1$, the UE is expected to report a PMI which indicates predicted precoder matrices associated with slot intervals $[l+j⋅d, l+(j+1)⋅d-1]$, for $j=0,…,N\_{4}-1$~~, where the initial slot~~ $l$ ~~is configured by the slot offset~~ $δ\in \{-n\_{CSI\\_ref},0,1,2\}$~~, with~~ $n\_{CSI\\_ref}$ ~~defined in Clause 5.2.2.5~~. A UE can be configured with $N\_{4}>1$ if the higher layer parameter *codebookType* is set to 'typeII-Doppler-r18'. |

**Comment 5(TypeII Doppler):**For *N4*=1, both *d*=1 and *d*>1 are supported with $δ=-n\_{CSI\\_ref}$. Hence, the text of ‘the value $δ=-n\_{CSI\\_ref}$ can be configured only for $d>1$’ is not inaccurate. According to the following conclusion, if $δ=-n\_{CSI\\_ref}$ and *d*=1, there is no enhancement to UE measurement and CSI calculation. Therefore, the relevant description in 5.2.1.4.2 of 38.214 should be revised.

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| **Conclusion** On the usage of CSI reporting and measurement for the Rel-18 Type-II codebook refinement for high/medium velocities, there is no consensus in *supporting any specification enhancement* for the following assumptions:* Legacy UE procedure for CSI measurement/calculation (equivalent to the combination of *l* = (*n* – *nCSI,ref* ) and WCSI=1)
* gNB-side prediction
	+ Note: This doesn’t preclude any gNB implementation
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**Proposed change:**

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| Subject to UE capability, a UE configured with a *CSI-ReportConfig* with the higher layer parameter *N4* and *reportQuantity* set to 'cri-RI-PMI-CQI' is assumed to support UE-side CSI prediction. The reported PMI indicates predicted precoder matrices associated with $N\_{4}$ consecutive slot intervals, each with duration of $d$ slots, where the value of $N\_{4}\in \{1,2,4,8\}$ is configured by *N4*. If the UE is configured with an aperiodic CSI-RS resource set for channel measurement, the value, in number of slots, of the time unit $d\in \{1,m\}$ is configured by higher layer parameter *d*, where $m$ is defined in Clause 5.2.1.4.1. If the UE is configured with a periodic or semi-persistent CSI-RS resource set for channel measurement, the value of $d$ is equal to the periodicity of the CSI-RS resource. The earliest of the $N\_{4}$ slot intervals starts at slot $l=n+δ$, where $n$ is the uplink slot in which the CSI is reported and the slot offset $δ$ is configured by higher layer parameter *delta*.- For $N\_{4}=1$, the UE is expected to report a predicted PMI for slot interval $[l,l+d-1]$, where the initial slot $l$ is configured by the slot offset $δ\in \{-n\_{CSI\\_ref},0,1,2\}$ ~~and the value~~ $δ=-n\_{CSI\\_ref}$ ~~can be configured only for~~ $d>1$~~.~~ , except for $δ=-n\_{CSI\\_ref}$ and *d*=1, the UE is expected to report a non-predicted PMI as described in Clause 5.2.2.2.5 or Clause 5.2.2.2.6. A UE can be configured with $N\_{4}=1$ if the higher layer parameter *codebookType* is set to 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18'. |

**Comment 6(TypeII Doppler):**For Rel-18 TypeII codebook, $2\leq K\leq 8$ resources in one NZP CSI-RS Resource set are supported, but can’t be configured with two Resource Groups. Therefore, the following paragraph in 5.2.1.4.1 of 38.214 is not applicable to Rel-18 TypeII codebook.**Proposed change:**

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| Except for a *CSI-ReportConfig* configured with *reportQuantity* set to 'cri-RI-PMI-CQI' and *codebookType* set to 'typeII-CJT-r18', 'typeII-CJT-PortSelection-r18', 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18', An NZP CSI-RS Resource Set for channel measurement with $2\leq K\_{s}\leq 8$ resources can be configured with two Resource Groups, with $K\_{1}\geq 1$ resources in Group 1 and $K\_{2}\geq 1$ resources in Group 2, such that $K\_{1}+K\_{2}=K\_{s}$, and with $N\in \{1,2\}$ Resource Pairs. Each Resource Pair consists of one resource from Group 1 and one resource from Group 2. The same resource can be associated with two Resource Pairs in frequency range 1 but not in frequency range 2. |

**Comment 7(TypeII Doppler):**For Rel-18 CJT, the parameter *codebookType* is used to enable this feature. For Rel-18 predicting CSI, some texts in 38.214 use the parameter *codebookType* to enable this feature, and some texts use the parameter *N4* to identify this feature. We think it is better to use only one RRC parameter to identify one feature. Therefore, we suggest that the RRC parameter *codebookType* should be used to enable Rel-18 predicting CSI for all texts in 38.214.**Proposed change:**

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| 5.2.1.4.1Subject to UE capability, a UE configured with a *CSI-ReportConfig* with the higher layer parameter *~~N4~~**codebookType* set to 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18' and *reportQuantity* set to 'cri-RI-PMI-CQI' is assumed to support UE-side CSI prediction. The reported PMI indicates predicted precoder matrices associated with $N\_{4}$ consecutive slot intervals, each with duration of $d$ slots, where the value of $N\_{4}\in \{1,2,4,8\}$ is configured by *N4*. If the UE is configured with an aperiodic CSI-RS resource set for channel measurement, the value, in number of slots, of the time unit $d\in \{1,m\}$ is configured by higher layer parameter *d*, where $m$ is defined in Clause 5.2.1.4.1. If the UE is configured with a periodic or semi-persistent CSI-RS resource set for channel measurement, the value of $d$ is equal to the periodicity of the CSI-RS resource. The earliest of the $N\_{4}$ slot intervals starts at slot $l=n+δ$, where $n$ is the uplink slot in which the CSI is reported and the slot offset $δ$ is configured by higher layer parameter *delta*.5.2.1.4.2Subject to UE capability, a UE configured with a *CSI-ReportConfig* with the higher layer parameter *~~N4~~* *codebookType* set to 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18' and *reportQuantity* set to 'cri-RI-PMI-CQI' is assumed to support UE-side CSI prediction. The reported PMI indicates predicted precoder matrices associated with $N\_{4}$ consecutive slot intervals, each with duration of $d$ slots, where the value of $N\_{4}\in \{1,2,4,8\}$ is configured by *N4*. If the UE is configured with an aperiodic CSI-RS resource set for channel measurement, the value, in number of slots, of the time unit $d\in \{1,m\}$ is configured by higher layer parameter *d*, where $m$ is defined in Clause 5.2.1.4.1. If the UE is configured with a periodic or semi-persistent CSI-RS resource set for channel measurement, the value of $d$ is equal to the periodicity of the CSI-RS resource. The earliest of the $N\_{4}$ slot intervals starts at slot $l=n+δ$, where $n$ is the uplink slot in which the CSI is reported and the slot offset $δ$ is configured by higher layer parameter *delta*.If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI', ' cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI' or 'cri-RI-LI-PMI-CQI', then the UE is not expected to be configured with more than 8 CSI-RS resources in a CSI-RS resource set contained within a resource setting that is linked to the *CSI-ReportConfig*, except when the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *~~N4~~ codebookType* set to 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18', *reportQuantity* set to 'cri-RI-PMI-CQI' and the corresponding CSI-RS resource set for channel measurement is aperiodic with $K=12$ resources. |

 | OKThe following agreement is clear that the restricted configuration $N=N\_{TRP}$ does not exclude $N\_{TRP}=1.$ This understanding is also confirmed in the RRC parameter description sent to RAN2, where restrictedCMR-Selection is not configured only for dynamic TRP selection, which is not applicable to the case $N\_{TRP}=1.$ **Agreement** (RAN1#110bis-e)… the selection of N CSI-RS resources is performed by UE and reported as a part of CSI report where N$\in ${1,..., NTRP}… * A restricted configuration (gNB-configured via higher-layer signaling) where N=NTRP is supported
	+ NTRP-bit bitmap is not reported when the restriction is configured

… OKOK, the value set for $δ$ and the optionality of $δ=-n\_{CSI\\_ref}$ are moved to the previous paragraph, as suggestedIn my reading of the conclusion, Rel18 Type-II-Doppler codebooks are not applicable if the CSI reporting window $W\_{CSI}$ starts at the reference resource and its duration is one slot. This is because legacy Rel16/17 codebooks apply in this case and there is no need to configure parameters $δ$ and $d$, because there is no CSI prediction.The proposal, instead, introduces a special configuration of Rel18 Doppler codebooks, where the reported CSI is not predicted and the UE behaviour is the same as legacy.Agree. In fact, a resource set configuration with two resource groups is used only for NCJT CSI reporting. Because there are other reporting quantities that are excluded, the list of exceptions would be long.From editor’s perspective, it’s better to specify in the following section 5.2.1.4.2 the exact report quantity configuration applicable to these two resource groups, so it’s clear that all other report quantity configuration are excludedIn my view, this is an editorial change. From editor’s perspective , because Rel18 introduced UE-side CSI prediction for the first time, it seems appropriate to distinguish the measurement/reporting framework that enables UE-side CSI prediction from the actual Rel-18 Doppler codebooks. This choice makes the specs more future-proof in case of codebook and/or measurement/reporting framework enhancements in future releases |
| ZTE | **Comment#1 (TDCP)**It was agreed that the number of CSI-RS resource sets used for TDCP measurement is limited as {1, 2, 3}. Therefore, we propose the following change.**Agreement (RAN1#114)**For the Rel-18 TRS-based TDCP reporting, the supported values of KTRS (number of configured TRS resource sets) are {1,2,3} * The candidate values {2,3} are UE optional

**Proposed change (section 5.2.1.2)**

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| For periodic and semi-persistent CSI Resource Settings, when the UE is configured with *groupBasedBeamReporting-r17*, the number of CSI Resource Sets configured is S=2, otherwise the number of CSI-RS Resource Sets configured is limited to S=1, except for periodic CSI Resource Settings, when the UE is configured with TDCP reporting, for which the number of CSI-RS Resource Sets in the CSI Resource Setting for channel measurement is limited to KTRS = {1, 2, 3} and all the CSI-RS Resource Sets are configured with the higher layer parameter *trs-Info*. |

**Comment#2 (Doppler CSI)**It was agreed that the value r=legacy Z2’ for $Z\_{2}^{'}+r$. Therefore, we propose the following change in red.**Agreement (RAN1#114)**For the Rel-18 Type-II codebook refinement for high/medium velocities, regarding Z/Z’ for Capability 2, r=legacy Z2’**Proposed change (section 5.4)**

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| - $(Z\_{2}+14\left(K-1\right)m,Z\_{2}^{'})$ or $(Z\_{2}+14\left(K-1\right)m+Z\_{2}^{'},2Z\_{2}^{'})$, according to UE reported capability, with $(Z\_{2},Z\_{2}^{'})$ of table 5.4-2, if the CSI report is configured with $N\_{4}>1$, *codebookType* is set to ‘typeII-Doppler-r18’ and the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement is aperiodic with $K$ CSI-RS resources, or- $(Z\_{2}+w,Z\_{2}^{'})$ or $(Z\_{2}+w+Z\_{2}^{'},2Z\_{2}^{'})$, according to UE reported capability, with $(Z\_{2},Z\_{2}^{'})$ of table 5.4-2, if the CSI report is configured with $N\_{4}>1$, *codebookType* is set to ‘typeII-Doppler-r18’ and the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement is periodic or semi-persistent with a single CSI-RS resource, or |

**Comment#3 (CJT/Doppler-CSI)**In RAN1#112, it is agreed that only one NZP-IMR/ZP-IMR can be configured for both CJT/Doppler-CSI, but, for now, it seems that corresponding restriction for NZP-IMR for interference measurement for both CJT and Doppler CSI is not specified. **Conclusion**For the Rel-18 Type-II codebook refinement for CJT mTRP, regarding interference measurement, beyond that supported in legacy specification, there is no consensus on supporting any additional enhancement on IMR (including the configuration for NZP CSI-RS for interference measurement or CSI-IM in relation to the configured CMR(s)).* Note: This implies that only one NZP CSI-RS resource for interference measurement or only one CSI-IM resource can be configured irrespective of the value of NTRP

**Agreement**For the Rel-18 Type-II codebook refinement for high/medium velocities, regarding CSI calculation and measurement, * The number of CSI-RS ports is the same for all the K configured CSI-RS resources comprising the CMR and the antenna ports for the same antenna port index across the K CSI-RS resources are the same.
* All the K configured CSI-RS resources comprising the CMR share the same BW and RE locations
* For interference measurement, legacy specification is fully reused, including the configuration for NZP CSI-RS for interference measurement or CSI-IM in relation to the configured CMR, i.e. only one NZP CSI-RS resource for interference measurement or only one CSI-IM resource can be configured irrespective of the value of K

…**Proposed change (Section 5.2.1.4.1):****-------------------------**A UE configured with a CSI-ReportConfig with the higher layer parameter reportQuantity set to 'cri-RI-PMI-CQI' and codebookType set to 'typeII-CJT-r18' or 'typeII-CJT-PortSelection-r18' is expected to be configured with 1≤K≤4 CSI-RS resources in a resource set for channel measurement. If interference measurement is performed on CSI-IM, only one resource is configured in the corresponding csi-IM-ResourceSet. If interference measurement is performed on NZP CSI-RS, only one resource is configured in the corresponding *NZP-CSI-RS-ResourceSet*.A UE configured with a CSI-ReportConfig with the higher layer parameter N4 and reportQuantity set to 'cri-RI-PMI-CQI', is expected to be configured with K∈{4,8,12} aperiodic CSI-RS resources or with a single periodic or semi-persistent CSI-RS resource in the resource set for channel measurement. For an aperiodic CSI-RS resource set for channel measurement, the K CSI-RS resources are triggered by the same triggering instance and the separation between two consecutive CSI-RS resources is m∈{1,2} slots, which is configured by higher layer parameter in the NZP-CSI-RS-ResourceSet. The UE shall assume that the antenna port with the same port index of the K aperiodic CSI-RS resources is the same. If interference measurement is performed on CSI-IM, only one resource is configured in the corresponding csi-IM-ResourceSet. If interference measurement is performed on NZP CSI-RS, only one resource is configured in the corresponding *NZP-CSI-RS-ResourceSet*.------------------------- | OKOKAgree with the observation. In fact, this is already captured in the section for all report types except L1-SINR:“Except for L1-SINR, if interference measurement is performed on NZP CSI-RS, a UE does not expect to be configured with more than one NZP CSI-RS resource in the associated resource set within the resource setting for interference measurement.” |
| NTT DOCOMO | **Comment#1 on IMR restriction for CJT/Doppler-CSI:** For the texts below, we have noticed this part exists for Doppler CSI only. We understand this comes from the slight difference between the corresponding agreements. [below copied from CR] After the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI, the UE reports a CSI report only after receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement no later than CSI reference resource and drops the report otherwise.For a *CSI-ReportConfig* configured with *codebookType* set to 'typeII-CJT-r18' or 'typeII-CJT-PortSelection-r18', the UE reports a CSI report only after receiving at least one CSI-RS transmission occasion for each of the CSI-RS resources in the corresponding CSI-RS Resource Set for channel measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise.For a *CSI-ReportConfig* configured with *codebookType* set to 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18', the UE reports a CSI report only if receiving at least one aperiodic or $K\_{p}$ periodic or semipersistent consecutive CSI-RS transmission occasions for each CSI-RS resource in the corresponding CSI-RS Resource Set for channel measurement and/or one CSI-IM occasion for interference measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise.[Copy end] Meanwhile, in our understanding, RAN1 does not intend to make any difference on interference measurement behavior between CJT and Doppler in the spec. If this is the case, it might be better to have aligned texts in between in our view. To do so, there may be two alternatives:* Alt-1: Add “and/or one CSI-IM occasion for interference measurement” to CJT part
* Alt-2: Remove ““and/or one CSI-IM occasion for interference measurement” to Doppler part
	+ This may still work in our view, when the spec is read together with the legacy text before the added parts

Alt-1 may look like the following: Based on above, we propose the following: For a *CSI-ReportConfig* configured with *codebookType* set to 'typeII-CJT-r18' or 'typeII-CJT-PortSelection-r18', the UE reports a CSI report only after receiving at least one CSI-RS transmission occasion for each of the CSI-RS resources in the corresponding CSI-RS Resource Set for channel measurement and/or one CSI-IM occasion for interference measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise.For a *CSI-ReportConfig* configured with *codebookType* set to 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18', the UE reports a CSI report only if receiving at least one aperiodic or $K\_{p}$ periodic or semipersistent consecutive CSI-RS transmission occasions for each CSI-RS resource in the corresponding CSI-RS Resource Set for channel measurement and/or one CSI-IM occasion for interference measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise.We’d just like to know Editor’s view on whether any of the alternatives above require additional agreement or not. If yes, we would be happy to consider submitting TP in the next RAN1 meeting. | Agree with your assessment, it seems the mention of CSI-IM occasion was left out in the CJT agreement unintentionally |
| Qualcomm | **Comment#1 (CJT)**

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| **Agreement (RAN1#113)**For the Rel-18 Type-II codebook refinement for CJT mTRP, on PDSCH EPRE assumption for CQI calculation, the UE can assume that the PDSCH EPRE follows a commonly configured *powerControlOffset* value for all the *N* selected CSI-RS resources* Note: For CSI calculation, the combined precoder across *N* selected (out of the configured *NTRP*) CSI-RS resources is normalized for each layer and the transmitted PDSCH across *N* selected (out of the configured *NTRP*) CSI-RS resources will be used in CSI calculation (up to the editor)
* Note: This doesn’t restrict how NW configures *powerControlOffset* for each CSI-RS resource in general. It pertains to UE assumption on CQI calculation for the CSI-RS resources used in the same CSI reporting setting for Rel-18 Type-II CJT
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According to the above agreement, UE-assumed power of PDSCH-CJT (which assumes the reported PMI as precoder) should be a summation across all N TRPs (all $NP$ ports).Therefore,**Proposed change (Section 5.2.2.5.1b):****-------------------------**- a UE should assume PDSCH signals on antenna ports in the set $[1000,…,1000+υ-1]$ for $υ$ layers would result in signals equivalent to corresponding symbols transmitted on antenna ports $[3000,…,3000+P-1]$ of each of the $N$ selected CSI-RS resources, as given by $\left[\begin{matrix}\begin{array}{c}y\_{σ\_{1}}^{\left(3000\right)}(i)\\\vdots \\y\_{σ\_{1}}^{\left(3000+P-1\right)}(i)\end{array}\\\begin{matrix}y\_{σ\_{2}}^{\left(3000\right)}(i)\\\vdots \\y\_{σ\_{2}}^{\left(3000+P-1\right)}(i)\\\vdots \\\begin{array}{c}y\_{σ\_{N}}^{\left(3000\right)}(i)\\\vdots \\y\_{σ\_{N}}^{\left(3000+P-1\right)}(i)\end{array}\end{matrix}\end{matrix}\right]=W\left(i\right)\left[\begin{array}{c}x^{\left(0\right)}\left(i\right)\\\vdots \\x^{\left(υ-1\right)}\left(i\right)\end{array}\right]$ where $W(i)$ is the precoding matrix corresponding to the procedure described in Clause 5.2.2.2.8 and 5.2.2.2.9 for codebookType set to 'typeII-CJT-r18' and ' typeII-CJT-PortSelection-r18', respectively, and $\{σ\_{1},…,σ\_{N}\}$ are the indices of the $N$ selected CSI-RS resources in increasing order, such that $1\leq σ\_{1}<…<σ\_{N}\leq N\_{TRP}$. A UE should assume that the signals $y\_{σ\_{j}}$, $j=1,…,N$, fully overlap in time and frequency.- a UE can assume that the PDSCH signals for $υ$ layers transmitted on the $NP$ antenna ports ~~of CSI-RS resource~~ $σ\_{j}$ would have the ~~same~~ ratio of EPRE to CSI-RS resource $σ\_{j}$’s EPRE for all $j=1,…,N$, equal to the *powerControlOffset* of the respective CSI-RS resource.**-------------------------** | Please see last comment |
| Huawei, HiSilicon | Regarding QC’s comment, we are not sure how the proposed wording could work. Because there will different pathloss for different TRP, the power ratio of total PDSCH to the different CSI-RS resources will be different. As a result, this will be inconsistent with the previous agreement of “commonly configured powerControlOffset”.In the previous agreement, “the UE can assume that the PDSCH EPRE follows a commonly configured *powerControlOffset* value for all the *N* selected CSI-RS resources”, it still follows the legacy behaviour that the corresponding part of PDSCH EPRE from a CSI-RS resource follows the configured powerControlOffset. Then there will be no problem when there’s different pathloss for TRPs. The editor’s wording is also aligned with the previous agreement. | Please see last comment |
| Qualcomm | Apologize for comments after “ddl” – please editor ignore this comment if this violates the rule, and we can leave this issue for the next maintenance meeting in October.-----Thanks for Huawei’s comments, cuz we think this part deserves more attention.The issue with current 214 wording is, the PDSCH power **portion** contributed by each TRP (“**N ports** of CSI-RS resource $σ\_{j}$,” $j=1,…,N$) can’t follow a set of N values of pre-configured *powerControlOffset*, regardless whether these N values are same (“commonly configured”) or different. The reason is, each power “portion” is determined by the reported PMI, which is dynamic and uncontrollable due to SVD for PMI calculation, and is not feasible to be pre-determined according to configuration. According to the RAN1#113 agreement, our understanding is, the PDSCH should not be seen as a per-TRP portion, but a summation over all TRPs (“combined precoder across *N*”). A figure for illustration: Regarding the agreement wording “commonly configured …,” there is conflict with another wording “This doesn’t restrict …”

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| **Agreement (RAN1#113)**For the Rel-18 Type-II codebook refinement for CJT mTRP, on PDSCH EPRE assumption for CQI calculation, the UE can assume that the PDSCH EPRE follows a commonly configured *powerControlOffset* value for all the *N* selected CSI-RS resources* Note: For CSI calculation, the combined precoder across *N* selected (out of the configured *NTRP*) CSI-RS resources is normalized for each layer and the transmitted PDSCH across *N* selected (out of the configured *NTRP*) CSI-RS resources will be used in CSI calculation (up to the editor)
* Note: This doesn’t restrict how NW configures *powerControlOffset* for each CSI-RS resource in general. It pertains to UE assumption on CQI calculation for the CSI-RS resources used in the same CSI reporting setting for Rel-18 Type-II CJT
 |

There can be 2 interpretations:* Interpretation1: TRP-common value. For instance, 3dB as in the figured example.
* Interpretation2: No restriction with different values, and an example is also illustrated in the figure.
	+ UE implementation perspective, this requires UE to scale each measured $H\_{N\_{r}×P}^{TRP\#σ\_{j}}$ accordingly, before SVD

We think either Interpretation1 or Interpretation2 can work, as long as PDSCH power is defined as summation. (Although our proposal is Interpretation2, we are OK with both).However, current 214 wording is exactly per-TRP contributed portion. And unfortunately, this has not drawn enough attentions.Lastly, an alternative TP for Interpretation1 is:**-------------------------**- a UE can assume that the PDSCH signals for $υ$ layers transmitted on the $NP$ antenna ports ~~of CSI-RS resource~~ $σ\_{j}$ would have the ~~same~~ ratio of EPRE to CSI-RS resource $σ\_{j}$’s EPRE for all $j=1,…,N$, equal to the commonly configured *powerControlOffset* of the respective CSI-RS resource.**-------------------------** | It seems some discussion during maintenance may be needed to align understanding between companies |

# 3 Discussion – second round

The comments in this section are based on version 1 of the draft CR available in the **Post RAN1#114 discussion.**

Please make your comments ASAP!

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| Company | Comments | Editor reply/Notes |
| ZTE | **Follow-up comments for our Comment#3 (CJT/Doppler-CSI) in first round**Thanks so much for editor’s raising other parts. After rethinking about that, we are a little bit worry whether Rel-15 restriction for NZP-CSI-RS is cancelled.

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| Section 5.2.1.4.1Except for L1-SINR, if interference measurement is performed on NZP CSI-RS, a UE does not expect to be configured with more than one NZP CSI-RS resource in the associated resource set within the resource setting for interference measurement. Except for L1-SINR, the UE configured with the higher layer parameter *nzp-CSI-RS-ResourcesForInterference* may expect no more than 18 NZP CSI-RS ports configured in a NZP CSI-RS resource set |

Although we have additional description for QCLed mapping between CSI-RS and NZP-IMR in the Section 5.2.1.2, it seems that it still increase the number of CSI-RS for channel measurement for legacy/Rel-15 CSI report.

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| The following are configured via higher layer signaling for one or more CSI Resource Settings for channel and interference measurement:- CSI-IM resource for interference measurement as described in Clause 5.2.2.4. - NZP CSI-RS resource for interference measurement as described in Clause 5.2.2.3.1.- NZP CSI-RS resource for channel measurement as described in Clause 5.2.2.3.1.The UE may assume that the NZP CSI-RS resource(s) for channel measurement and the CSI-IM resource(s) for interference measurement configured for one CSI reporting are resource-wise QCLed with respect to 'typeD'. When NZP CSI-RS resource(s) is used for interference measurement, the UE may assume that the NZP CSI-RS resource for channel measurement and the CSI- IM resource or NZP CSI-RS resource(s) for interference measurement configured for one CSI reporting are QCLed with respect to 'typeD'. |

If above understanding is correct, our previous suggestion of just being based on corresponding paragraphs for CJT/Doppler-CSI may be a little bit clear, and then, in next meeting, we may further review the above resource-wise QCL rule applying to CJT/Doppler-CSI or not. Thanks again.  | Thanks for elaborating further! I think the best course of action is to take this into discussion in the next meeting and not perform any additional changes for now, since there seems some uncertainty in the air anyway! I suppose this is OK with you! |
| **Editor 07.09** | **No further changes made, v01 draft CR stays for endorsement!** |  |
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