**3GPP TSG-RAN WG4 Meeting #98-e R4-21xxxxx**

**Electronic Meeting, 25 Jan - 5 Feb, 2021**

**Agenda item:** 7.16

**Source:** Moderator (China Telecom)

**Title:** Email discussion summary for [98e][326] NR\_perf\_enh\_Demod

**Document for:** Information

# Introduction

This email thread discusses the NR Rel-16 demodulation performance requirements in agenda 7.16. Note that no tdoc has been submitted for BS demodulation in agenda 7.16.2 in this meeting.

List of candidate target of email discussion for 1st round and 2nd round:

* 1st round: Invite companies to review the recommended WF in section 1~5, and provide comments (if any) in section 1.3, 2.3, 3.3, 4.3 and 5.3.
* 2nd round: TBA

# Topic #1: Release independent aspect

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100787 | China Telecom | CR for TS 38.307 on UE demodulation performance requirements (Rel-15) |
| R4-2100788 | China Telecom | CR for TS 38.307 on UE demodulation performance requirements (Rel-16) |
| R4-2100789 | China Telecom | CR for TS 38.307 on UE demodulation performance requirements (Rel-17) |

## Open issues summary

*No open issue.*

## Companies views’ collection for 1st round

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2100787, Rel-15 38.307 CR, Cat. B, CTC | Company A:  |
| Company B: |
|  |
| R4-2100788, Rel-16 38.307 CR, Cat. B, CTC | Company A:  |
| Company B: |
|  |
| R4-2100789, Rel-17 38.307 CR, Cat. A, CTC (Not uploaded yet) | Company A:  |
|  |
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Note: To save time on typing the comments one by one, companies can also directly revise the draft CR and upload the revision in the draft inbox.

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
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*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
|  |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
|  |  |

# Topic #2: UE CA PDSCH requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100786 | China Telecom | Proposal 1: Use option 1 for the antenna connection for FR1 CA tests with 4 RX.Observation 1: The agreed procedure for selecting CA configuration(s) and CBW combination can be used to find the test scenario where UE support at least 2 layer on each CC. |
| R4-2100816 | CMCC | CR for NR PDSCH FR1 CA 2Rx performance requirements |
| R4-2100822 | CMCC | Issue1: Antenna connection for CA tests with 4 RXProposal 1: We support to reuse the same antenna connection for CA tests with 4RX in LTE* + If any of the PCell and/or the SCells is a 4 RX supported RF band, all 4 RX should be connected with data source from system simulator.
	+ If any of the PCell and/or the SCells is a 2 RX supported RF band, 2 out of the 4 RX should be connected with data source from system simulator, and the other 2 RX are connected with zero input.

Issue2: How to test the UE which does not support 2-layer transmission on all CCs for all supported CA configurations.In our point of view, the case that UE does not support 2-layer transmission on all CCs for all supported CA configurations is a conner case, no further discussion is needed in this stage. |
| R4-2101254 | Intel Corporation | Proposal 1: Reuse LTE applicability rule and antenna connection approach defined in 8.1.2.6.5 of 36.101 for NR CA testing of 4 Rx capable UEs.Proposal 2: Add the following clarification to NR CA applicability rules: “Verify UEs only on CCs, for which the supported maximum number of MIMO layers is not lower than 2. OCNG pattern is used for CCs, for which the supported maximum number of MIMO layers is 1, and performance is not verified on these CCs”. |
| R4-2101255 | Intel Corporation | CR on applicability rules for Normal NR CA requirements |
| R4-2101365 | Huawei, HiSilicon | Proposal 1: Reuse the test applicability rule defined for single carrier for CA tests with 2Rx and 4Rx, i.e. * + Only conducted CA tests with 2Rx for UE only supports 2Rx
	+ Only conducted CA tests with 4Rx for UE only supports 4Rx
	+ Only conducted CA tests with 4Rx for UE supports both 2Rx and 4Rx
	+ Not conducted CA test with 4Rx for UE only supports 2Rx
* Proposal 2: No further discussion on how to test UE that does not support 2-layer transmission on all CCs for all supported CA configurations is needed.
 |
| R4-2101434 | Ericsson | Draft CR: Section numbering for PDSCH CA demodulation requirementsIt is important that the clause numberings are aligned between RAN5 conformance test specification and RAN4 specification at least on top test case title level. Also RAN5 test cases are common for 2Rx and 4Rx. However the current RAN4 PDSCH CA requirement specification structure is not aligned with other requirements, that is, the PDSCH CA requrements and power imbalance requirements are inside the 2Rx and 4Rx sections. For efficient RAN5 operation maintaining the clause number alignment, it is desirable that the 2Rx/4Rx requirements are added in the lowest clause number level, and any new features are added independently on the antenna number in a separate clause. |
| R4-2102818 | Qualcomm Incorporated | Proposal 1: Implement clause restructure of the CA PDSCH Demodulation and CA CQI reporting test cases in 38.101-4 spec as per option 1. If option 1 is not possible due to TS drafting rules, implement option 2.Option 1:5.2A                   PDSCH Demodulation requirements for CA5.2A.1                Minimum requirements (normal PDSCH)5.2A.1.1            1RX requirements (Void)5.2A.1.2            2RX requirements 5.2A.1.3            4RX requirements 5.2A.2                Minimum requirements for carrier aggregation with power imbalance5.2A.2.1            1RX requirements (Void)5.2A.2.2            2RX requirements 5.2A.2.3            4RX requirementsOption 2:If option 1 is not possible due to TS drafting rules, this could be another option5.2A                   PDSCH Demodulation requirements for CA5.2A.1                Void5.2A.2                Void5.2A.3                Void5.2A.4                Minimum requirements (normal PDSCH)5.2A.4.1            1RX requirements (Void)5.2A.4.2            2RX requirements 5.2A.4.3            4RX requirements 5.2A.5                Minimum requirements for carrier aggregation with power imbalance5.2A.5.1            1RX requirements (Void)5.2A.5.2            2RX requirements 5.2A.5.3            4RX requirements |

## Open issues summary

### Sub-topic 2-1: Specification section numbering

**Issue 2-1: Section numbering for PDSCH CA demodulation requirements**

* Current section numbering:

5.2A PDSCH Demodulation requirements for CA

 5.2A.1 1RX requirements (Void)

 5.2A.2 2RX requirements

 5.2A.2.1 Minimum requirements (normal PDSCH)

 5.2A.2.2 Minimum requirements for carrier aggregation with power imbalance

 5.2A.3 4RX requirements

 5.2A.3.1 Minimum requirements (normal PDSCH)

 5.2A.3.2 Minimum requirements for carrier aggregation with power imbalance

7.2A PDSCH Demodulation requirements for CA

 7.2A.1 1RX requirements (Void)

 7.2A.2 2RX requirements

 7.2A.2.1 Minimum requirements (normal PDSCH)

* Issues with the current section numbering (E///, QC)
	+ It is important that the clause numberings are aligned between RAN5 conformance test specification and RAN4 specification at least on top test case title level. Also RAN5 test cases are common for 2Rx and 4Rx.
	+ However the current RAN4 PDSCH CA requirement specification structure is not aligned with other requirements, that is, the PDSCH CA requrements and power imbalance requirements are inside the 2Rx and 4Rx sections.
	+ For efficient RAN5 operation maintaining the clause number alignment, it is desirable that the 2Rx/4Rx requirements are added in the lowest clause number level, and any new features are added independently on the antenna number in a separate clause.
* Proposals
	+ Option 1 (E///, QC)

5.2A PDSCH Demodulation requirements for CA

 5.2A.1 Void

 5.2A.2 Void

 5.2A.3 Void

 5.2A.4 Minimum requirements

 5.2A.4.1 1RX requirements (Void)

 5.2A.4.2 2RX requirements

 5.2A.4.3 4RX requirements

 5.2A.5 Minimum requirements for carrier aggregation with power imbalance

 5.2A.5.1 1RX requirements (Void)

 5.2A.5.2 2RX requirements

 5.2A.5.3 4RX requirements

7.2A PDSCH Demodulation requirements for CA

 7.2A.1 Void

 7.2A.2 Void

 7.2A.3 Minimum requirements

 7.2A.3.1 1RX requirements (Void)

 7.2A.3.2 2RX requirements

* + Option 2 (if allowed by TS drafting rules):

5.2A                   PDSCH Demodulation requirements for CA

 5.2A.1                Minimum requirements (normal PDSCH)

 5.2A.1.1            1RX requirements (Void)

 5.2A.1.2            2RX requirements

 5.2A.1.3            4RX requirements

 5.2A.2                Minimum requirements for carrier aggregation with power imbalance

 5.2A.2.1            1RX requirements (Void)

 5.2A.2.2            2RX requirements

 5.2A.2.3            4RX requirements

* Recommended WF
	+ Encourage feedback from more companies.
	+ If the proposed option 1 or option 2 is agreeable, suggest to prepare formal CR in this RAN4 meeting, to facilitate the RAN5 work in RAN5 #90e meeting. In addition, the section numbering for CA CQI needs to be updated accordingly.

### Sub-topic 2-2: PDSCH CA test applicability

**Issue 2-2-1: Antenna connection for CA tests with 4 RX**

* *Agreement in RAN4 #97e (R4-2017561, WF)*
	+ *Option 1:*
		- *If any of the PCell and/or the SCells is a 4 RX supported RF band, all 4 RX should be connected with data source from system simulator.*
		- *If any of the PCell and/or the SCells is a 2 RX supported RF band, 2 out of the 4 RX should be connected with data source from system simulator, and the other 2 RX are connected with zero input.*
	+ *Other options are not precluded*
* Proposals
	+ Option 1, i.e., reuse the same antenna connection for CA tests with 4RX in LTE (CTC, CMCC, Intel)
		- CTC: With option 1, the antenna connections for different scenarios (including all bands with 2RX, all bands with 4RX, 2RX bands + 4RX bands) are clear.
		- Intel: Two types of 4 Rx capable UEs may exist in the field: Type 1 (UEs only support 2Rx in certain bands and support 4Rx in the other bands) and Type 2 (UEs support 4Rx in all the bands). For Type 1 4 Rx capable UEs, test can be applied for CA configuration with mix of 2 and 4 Rx support.
	+ Option 2: Reuse the test applicability rule defined for single carrier for CA tests with 2Rx and 4Rx, i.e. (HW)
		- Only conducted CA tests with 2Rx for UE only supports 2Rx
		- Only conducted CA tests with 4Rx for UE only supports 4Rx
		- Only conducted CA tests with 4Rx for UE supports both 2Rx and 4Rx
		- Not conducted CA test with 4Rx for UE only supports 2Rx
* Recommended WF
	+ The main difference is on how to test UE supporting 2Rx in certain bands and supporting 4Rx in the other bands.
	+ Considering the majority companies’ view, can we go with option 1?

**Issue 2-2-2: Applicability for UEs not supporting 2-layer transmission on all CCs**

* Proposals
	+ Option 1: No further discussion is needed (CTC, CMCC, HW)
		- CTC: The agreed procedure for selecting CA configuration(s) and CBW combination can be used to find the test scenario where UE support at least 2 layer on each CC.
		- CMCC: the case that UE does not support 2-layer transmission on all CCs for all supported CA configurations is a conner case.
		- HW: Based on our understanding on the test applicability rule, for the selected CA configuration for test, only CCs supporting maximum number of MIMO layers not lower than 2 will be selected for tests, other CCs of the selected CA configuration not support maximum number of MIMO layers not lower than 2 will not be selected at all.
	+ Option 2: Add the following clarification to NR CA applicability rules (Intel)
		- “Verify UEs only on CCs, for which the supported maximum number of MIMO layers is not lower than 2. OCNG pattern is used for CCs, for which the supported maximum number of MIMO layers is 1, and performance is not verified on these CCs”.
* Recommended WF
	+ Can we go with option 1? Is the clarification in option 2 necessary?

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | Issue 2-1: Section numbering for PDSCH CA demodulation requirementsIssue 2-2-1: Antenna connection for CA tests with 4 RXIssue 2-2-2: Applicability for UEs not supporting 2-layer transmission on all CCs |
| Company B | Issue 2-1: Section numbering for PDSCH CA demodulation requirementsIssue 2-2-1: Antenna connection for CA tests with 4 RXIssue 2-2-2: Applicability for UEs not supporting 2-layer transmission on all CCs |
| CMCC | Issue 2-2-1: Antenna connection for CA tests with 4 RXSupport recommended WF to go with Option1Issue 2-2-2: Applicability for UEs not supporting 2-layer transmission on all CCsSupport Option1 |
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### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2100816, CMCC, FR1 CA 2Rx | Company A: |
| Company B: |
|  |
| R4-2101254, Intel, applicability rules | CMCC: Since the sub-clause 5.1.1.7.3 in CR “Applicability rule and antenna connection for **CA** tests with 4 RX” is for **CA** tests, we propose to modify the description like below:Within the CA~~/DC~~ configuration if any of the PCell and/or the SCells/PSCell is a 2Rx supported RF band, 2 out of the 4Rx should be connected with data source from system simulator, and the other 2Rx are connected with zero input, depending on UE’s declaration and AP configuration. Requirements from Clause 5.2A.2.1 are applied.Within the CA~~/DC~~ configuration if any of the PCell and/or the SCells is a 4Rx supported RF band, all 4Rx should be connected with data source from system simulator. Requirements from Clause5.2A.3.1 are applied. |
| Company B: |
|  |
| R4-2101434, Ericsson, Draft CR: Section numbering for PDSCH CA  | Company A:  |
| Company B: |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary**  |
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*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
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## Discussion on 2nd round

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
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# Topic #3: UE PMI reporting requirements with larger number of Tx ports

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100216 | Apple | Proposal #1: Define PMI reporting requirements with Type II codebook at 90% Max TP. |
| R4-2100897 | Samsung | Wrong document submitted, revised to R4-2102939. |
| [R4-2100902](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100902.zip) | Samsung | Simulation results for Type II and Type I codebook based on the agreements in RAN4 #97e meeting.Observation 1-MIMO Correlation: It is observed that the performance gain with Type II compared to Type I codebook in XP medium MIMO correlation is larger than in Custom Low correlation cases. Especially for 16x2 ‘Custom Low’, there is marginal gain for Type II codebook. Observation 2-Test Metric: As shown in table 2.1~2.3, the TP ratios are reasonable and the SNR points are workable under the “following Type II PMI vs. random Type I PMI” test metrics. Observation 3-Test point: The performance gap between following Type II and Type I is more obvious under 70% relative TP point than 90%, and 95% points.Observation 4- Performance gap between Type II and Type (XP-Medium with 70% relative test point): 2.5dB around SNR gap for 2Rx cases, 1.5dB around SNR gap for 4Rx casesProposal 1: Introduce Type II codebook test cases * SU-MIMO set-up
* MIMO correlation: XP Medium MIMO correlation
* Test metric: Relative TP between following Type-II/random PMI with Type I codebook
* Test point: relative 70% TP with following PMI
 |
| [R4-2101317](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101317.zip) | Huawei, HiSilicon | Simulation results for Type II codebook PMI reporting test |
| [R4-2101318](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101318.zip) | Huawei, HiSilicon | Proposal 1: Use 95% maximum throughput to be the test point for eType II codebook |
| [R4-2101322](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101322.zip) | Huawei, HiSilicon | CR for 38.101-4: Applicability for NR PMI requirements with Tx ports larger than 8 and up to 32 |
| [R4-2101435](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101435.zip) | Ericsson | Simulation results. |
| [R4-2101436](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101436.zip) | Ericsson | Proposal: RAN4 revisit the metric of Rel-15 Type-II PMI reporting test to ensure the UE reporting Type-I cannot pass the tests, e.g., following Type-II PMI over following Type-I PMI. |
| [R4-2101437](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101437.zip) | Ericsson | CR Correction of title on 16Tx port subband PMI reporting |
| [R4-2102821](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102821.zip) | Qualcomm Incorporated | Proposal 1: Use 90% test point for defining Type II PMI reporting test cases.Proposal 2: Use the test metric of throughput ratio between following Type II and random Type I for defining Type II PMI reporting tests and no need to check whether UE reported codebook is not only within Type I codebook set.Proposal 3: Use XP Medium correlation for defining Type II PMI reporting tests. |
| R4-2102939 | Samsung | CR Introduction of PMI test cases with Rel-15 Type II codebook |

## Open issues summary

**Issue 3-1: Test metric for type II codebook**

* *Agreement in RAN4 #97e (R4-2017681, WF)*
	+ *Test metric:*
		- *Following PMI (Type II)/Random PMI (Type I codebook) (gamma values) based on the assumption that there are ensure enough performance difference over than Type I i.e., UE which employ Type I reporting will fail in the test case*
			* *This test metric applied to UE which support Type II codebook feedback irrespective whether supporting Type I codebook feedback or not*
		- *FFS: Whether to check UE reported codebook not only within Type I codebook set*
* Proposals
	+ Option 1: Following PMI (Type II)/Random PMI (Type I codebook) (gamma values) (Samsung, QC, [Apple], [HW])
		- Samsung: TP ratios are reasonable and the SNR points are workable under the “following Type II PMI vs. random Type I PMI” test metrics.
	+ Option 2: Following Type-II PMI / following Type-I PMI (E///)
		- E///: There is less performance difference or almost no performance difference in terms of gamma value between the Type-I PMI reporting and Type-II PMI reporting.
* Recommended WF
	+ Considering this is the last meeting for the WI, can we go with option 1 based on majority’s view? Any additional measure point to address E///’s concern?

**Issue 3-2: SNR point for type II codebook**

* *Agreement in RAN4 #97e (R4-2017681, WF)*
	+ *Test point*
		- *Option 1: 70%*
		- *Option 2: 90% (baseline)*
		- *Option 3: 95%*
		- *Other options not excluded*
* Proposals
	+ Option 1: 70% (Samsung)
		- Samsung: Performance gap between following Type II and Type I is more obvious under 70% relative TP point than 90%, and 95% points.
	+ Option 2: 90% (Apple, QC)
		- Apple: At 90% max TP, we have 3 dB gain in performance and considerable difference in TP gain. Using a lower test point like 80% or 70% max TP would result in larger delta between Type II and Type I results.
		- QC: Link adaptation algorithms try to keep the UE PDSCH BLER closer to 10%.
	+ Option 3: 95% (HW)
		- HW: The ratio between Type II follow PMI and Type I random PMI on 70% and 90% of maximum throughput is too large to be set as a proper test metric.
* Recommended WF
	+ 4 companies proposed 3 different options due to different observations from the simulation results.
		- In general, in all companies’ results, with higher percentage of TP point, smaller performance gap between following Type II and random Type I is observed; but the amount of the gap is quite different in different companies’ simulation results.
	+ In the 1st round, encourage companies to double check the simulation results, and check if there is another acceptable option in addition to the favourite option?

**Issue 3-3: MIMO correlation for type II codebook**

* *Agreement in RAN4 #97e (R4-2017681, WF)*
	+ *MIMO correlation*
		- *XP Medium as Baseline*
		- *XP (custom) Low only can be considered if XP medium not workable*
* Proposals
	+ Option 1: XP Medium (Samsung, QC)
		- Samsung: The performance gain with Type II compared to Type I codebook in XP medium MIMO correlation is larger than in Custom Low correlation cases. Especially for 16x2 ‘Custom Low’, there is marginal gain for Type II codebook.
* Recommended WF
	+ Use XP Medium.

**Issue 3-4: Simulation results and gamma value**

* Summary of simulation results for following Type II/Random Type I

**Summary of FDD simulation results**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Antenna configuration | Correlation | Company | SNR Point [dB 95% max TP] | Gamma [95% max TP] | SNR Point [dB 90% max TP] | Gamma [90% max TP] | SNR Point [dB 70% max TP] | Gamma [70% max TP] |
| 16Tx / 2Rx | Medium | E/// | 14.5 | 1.6 | 12.4 | 1.9 | 7.8 | 2.2 |
| Apple |  |  | 10.56 | 2.92 |  |  |
| Samsung | 10.8 | 2.88 | 9.5 | 3.18 | 6.8 | 4.18 |
| Huawei |  |  | 9.82 |  |  |  |
| Custom Low | E/// | 12.8 | 1.7 | 10.9 | 1.8 | 7.2 | 2.1 |
| Samsung | 9.9 | 2.65 | 9.0 | 2.87 | 6.6 | 3.72 |
| 16Tx / 4Rx | Medium | E/// | 7.6 | 2.1 | 6.8 | 2.1 | 4.4 | 2.2 |
| Apple |  |  | 7.06 | 2.83 |  |  |
| Samsung | 8.6 | 2.01 | 7.6 | 2.24 | 5.2 | 2.51 |
| Huawei |  |  | 5.9 |  |  |  |
| Custom Low | E/// | 7.8 | 1.9 | 6.7 | 1.8 | 4.3 | 1.9 |
| Samsung | 6.9 | 2.27 | 5.8 | 2.38 | 4.0 | 2.41 |

**Summary of TDD simulation results**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Antenna configuration | Correlation | Company | SNR Point [dB 95% max TP] | Gamma [95% max TP] | SNR Point [dB 90% max TP] | Gamma [90% max TP] | SNR Point [dB 70% max TP] | Gamma [70% max TP] |
| 16Tx / 2Rx | Medium | E/// | 10.3 | 2.2 | 8.8 | 2.7 | 5.7 | 3.1 |
| Apple |  |  | 11.25 | 2.82 |  |  |
| Samsung | 13.3 | 1.87 | 11.3 | 2.12 | 7.8 | 2.43 |
| Huawei |  |  | 9.82 |  |  |  |
| Custom Low | E/// | 10.0 | 2.0 | 7.9 | 2.3 | 5.4 | 2.8 |
| Samsung | 10.8 | 2.03 | 9.3 | 2.23 | 6.4 | 2.51 |
| 16Tx / 4Rx | Medium | E/// | 5.3 | 2.4 | 4.5 | 2.5 | 2.5 | 2.6 |
| Apple |  |  | 7.15 | 2.81 |  |  |
| Samsung | 9.6 | 1.81 | 8.2 | 1.91 | 5.7 | 1.96 |
| Huawei |  |  | 5.9 |  |  |  |
| Custom Low | E/// | 5.4 | 1.9 | 4.6 | 2.0 | 2.5 | 1.9 |
| Samsung | 9.3 | 1.64 | 7.8 | 1.76 | 4.8 | 1.90 |

* **Observation**
	+ For the baseline parameter combination, i.e., Medium correlation + 90% max TP, 4 companies provided simulation results, and the SPAN of the SNR point is quite large for some cases, e.g., 3.7 for TDD 16T4R, 2.5 for TDD 16T2R, 2.9 for FDD 16T2R.
* Recommended WF
	+ In the 1st round, encourage companies to double check the simulation results

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | Issue 3-1: Test metric for type II codebookIssue 3-2: SNR point for type II PMI codebookIssue 3-3: MIMO correlation for type II codebook Issue 3-4: Simulation results and gamma valueOthers |
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### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| [R4-2101322](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101322.zip), HW, CR for Applicability | Company A |
| Company B |
|  |
|  |
| [R4-2101437](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101437.zip), E///, Correction of title on 16Tx port subband PMI | Company A |
| Company B |
|  |
| R4-2102939, Samsung, Introduction of PMI test cases with Rel-15 Type II codebook | Moderator’s note: Endorsed draft CR R4-2017569 with updates to the notes in Table 6.3.2.1.5-1, Table 6.3.2.2.5-1, Table 6.3.3.1.5-1 and Table 6.3.3.2.5-1. |
| Company A |
| Company B |
|  |

Note: To save time on typing the comments one by one, companies can also directly revise the draft CR and upload the revision in the draft inbox.

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
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*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
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## Discussion on 2nd round

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
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# Topic #4: UE power imbalance requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2101366 | Huawei, HiSilicon | Proposal 1: Add the following general rules in the specification and update the test applicability as shown in Table 1:* For UEs supporting FR1 intra-band contiguous and non-contiguous EN-DC and inter-band EN-DC, where the frequency range of the LTE band is a subset of the frequency range of the NR band, the requirements applicability is specified in Table 9.1.1-3
	+ For UE only supporting contiguous EN-DC, only performance requirements for contiguous EN-DC in clause 9.5B.1.1 are applicable
	+ For UE only supporting non-contiguous EN-DC, only performance requirements for non-contiguous EN-DC in 9.5B.1.2 are applicable
	+ For UE supporting both contiguous and non-contiguous EN-DC, only performance requirements for contiguous EN-DC in 9.5B.1.1 are applicable
 |
| R4-2101367 | Huawei, HiSilicon | CR: Updates to power imbalance for CA |

## Open issues summary

### Sub-topic 4-1: Test applicability rule for UE power imbalance for EN-DC

**Issue 4-1: Test applicability rule for UE power imbalance for EN-DC**

* Proposals
	+ Proposal 1: Add the following general rules in the specification and update the test applicability as shown in Table 1:
		- For UEs supporting FR1 intra-band contiguous and non-contiguous EN-DC and inter-band EN-DC, where the frequency range of the LTE band is a subset of the frequency range of the NR band, the requirements applicability is specified in Table 9.1.1-3
			* For UE only supporting contiguous EN-DC, only performance requirements for contiguous EN-DC in clause 9.5B.1.1 are applicable
			* For UE only supporting non-contiguous EN-DC, only performance requirements for non-contiguous EN-DC in 9.5B.1.2 are applicable
			* For UE supporting both contiguous and non-contiguous EN-DC, only performance requirements for contiguous EN-DC in 9.5B.1.1 are applicable
* Recommended WF
	+ Encourage feedback on proposal 1.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | Issue 4-1: Test applicability rule for UE power imbalance for EN-DC |
| Company B | Issue 4-1: Test applicability rule for UE power imbalance for EN-DC |
| CMCC | Issue 4-1: Test applicability rule for UE power imbalance for EN-DCIn our views, there is no need to add the general rules in the specification since the rules has been included in the Table 9.1.1-3 implicitly.The update of test applicability is as below for reference:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Inter-band scenarios are not supported  | UE indicates “interBandContiguousMRDC”i.e. support intra-band contiguous EN-DC requirements for supported inter-band EN-DC combinations (Note 1) | UE does not indicate “interBandContiguousMRDC”i.e. support intra-band non-contiguous EN-DC requirements for supported inter-band EN-DC combinations (Note 1) |
| Intra-band scenarios are not supported | N/A | Clause 9.5B.1.1 is executed for inter-band EN-DC scenarios | Clause 9.5B.1.2 is executed for inter-band EN-DC scenarios |
| UE does not indicate “*intraBandENDC-Support*” or UE indicates “*both*” in “intraBandENDC-Support”, i.e. supports intra-band contiguous or both intra-band contiguous and non-contiguous EN-DC for supported intra-band EN-DC combinations | Clause 9.5B.1.1 is only executed for intra-band EN-DC scenarios | Clause 9.5B.1.1 is executed for both intra-band and inter-band EN-DC scenarios | Clause 9.5B.1.1 is only executed for intra-band EN-DC scenarios |
|  |  |  |  |
| UE indicates “*non-contiguous*” in “*intraBandENDC-Support*”, i.e. supports only intra-band non-contiguous EN-DC for supported intra-band EN-DC combinations | Clause 9.5B.1.2 is only executed for intra-band EN-DC scenarios | Clause 9.5B.1.1 is executed for inter-band EN-DC scenarios | Clause 9.5B.1.2 is executed for both intra-band and inter-band EN-DC scenarios |

We are Ok to merge the third row and the fourth row of the original table, but we think it is not necessary to add the “i.e.” to the UE indication. We prefer to modify the table like below and also open to further discuss:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Inter-band scenarios are not supported  | UE indicates “interBandContiguousMRDC” (Note 1) | UE does not indicate “interBandContiguousMRDC”(Note 1) |
| Intra-band scenarios are not supported | N/A | Clause 9.5B.1.1 is executed for inter-band EN-DC scenarios | Clause 9.5B.1.2 is executed for inter-band EN-DC scenarios |
| UE does not indicate “*intraBandENDC-Support*” or UE indicates “*both*” in “intraBandENDC-Support” | Clause 9.5B.1.1 is only executed for intra-band EN-DC scenarios | Clause 9.5B.1.1 is executed for both intra-band and inter-band EN-DC scenarios | Clause 9.5B.1.1 is only executed for intra-band EN-DC scenarios |
| UE indicates “*non-contiguous*” in “*intraBandENDC-Support*” | Clause 9.5B.1.2 is only executed for intra-band EN-DC scenarios | Clause 9.5B.1.1 is executed for inter-band EN-DC scenarios | Clause 9.5B.1.2 is executed for both intra-band and inter-band EN-DC scenarios |

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### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2101367, HW, CR: Updates to UE power imbalance for CA |  |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
|  |  |

*Suggestion on WF/LS assignment*

|  |  |  |
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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
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## Discussion on 2nd round

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
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# Topic #5: NR CA CQI reporting requirements

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100886 | China Telecom | CR: Adding applicability and requirements for FR1 and FR2 CA CQI reporting test |

## Open issues summary

*No open issue.*

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2100886, CTC, CR on applicaability and requiremets |  |
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## Summary for 1st round

### Open issues

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
|  |  |