**3GPP TSG-RAN WG4 Meeting #110 R4-2402652**

**Athens, Greece, 26th Feb ‒1st Mar, 2024**

**Agenda item:** 8.1.4

**Source:** Moderator (Huawei, HiSilicon)

**Title:** Topic summary for [110][312] RF\_FR1\_enh2\_Demod

**Document for:** Information

# Introduction

This contribution provides the summary for the open issues on 8Rx demodulation requirements. Following topics are to be discussed:

* Topic #1: Single carrier requirements
* Topic #2: CA requirements
* Topic #3: Others
	+ Discussion on inclusion of perf requirements for 8Rx with intra-cell inter-user and inter-cell interference scenario
* Topic #4: CR

# Topic #1: Single carrier PDSCH requirements

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2402878 | Qualcomm | Proposal 1: For devices that only support up to 4-layers, RAN4 to consider an additional margin of at least 1.2 dB (on top of 0.8 dB) for 4L demod. requirements.  |
| R4-2400242 | Nokia, Nokia Shanghai Bell | [Proposal 1: RAN4 shall adopt an approach to remove outliers for defining requirements for 8Rx.](#_Toc155367066)[Proposal 2: RAN4 shall add 0.8dB margin for 64QAM (for Rank 2 and Rank 8)](#_Toc155367067)[Proposal 3: RAN 4 shall for Rank 4 : Define two sets of requirements applicable to UE support of maxNumberMIMO-LayersPDSCH = 8 and maxNumberMIMO-LayersPDSCH = 4 respectively.](#_Toc155367068)[Proposal 4: RAN4 could use TDLA 30-10 Low for defining requirements for CA for 8Rx Rank2 configurations.](#_Toc155367069)[Proposal 5: RAN4 could use MCS 17 for defining requirements for CA for 8Rx Rank2 configurations.](#_Toc155367070) |
| R4-2400422 | Apple | Proposal 1: Set the max allowed span to 3dB for ideal results alignment.Proposal 2: Add a 1.5dB margin for 64QAM on top of the averaged impairment results for requirements derivation. |
| R4-2400526 | MTK | Proposal 1: To deal the issue of large span in the simulation results alignment. We propose to set the max allowed span to 3dB.Proposal 2: Define two sets of requirements applicable to UE support of maxNumberMIMO-LayersPDSCH = 8 and maxNumberMIMO-LayersPDSCH = 4 respectively* Set A (maxNumberMIMO-LayersPDSCH=8): Add 0.8dB margin (the methodology used from NR UE Rel-15)
* Set B (maxNumberMIMO-LayersPDSCH=4): Add an additional margin on top of Set A results. When UE supports maxNumberMIMO-LayersPDSCH=4, an additional 1.5 dB margin (on top of 0.8dB margin in set A) is added to the SNR requirement
 |
| R4-2400793 | CTC | Proposal 1: Reuse the methodology for UE performance requirement definition as we have used since Rel-15.Proposal 2: companies to firstly align simulation assumptions before we discuss whether to consider larger SPAN or to consider larger margin. |
| R4-2401553 | Ericsson | Proposal 1: Clarify each receiver type and define two sets of requirement accordingly. |
| R4-2401668 | Huawei, HiSilicon | Observation 1: There are two different 8Rx receiver types:* Type1: Baseline 8Rx receiver: MIMO detector with 8Rx
* Type2: Simplified 8Rx receiver: UE performs two separate 4Rx MIMO detector and combines the LLR (Note that this receiver assumption can’t work for 8 layers)

Observation 2: 1.8dB and 3.8dB performance degradation for Rank 2 and Rank 4 cases respectively for Type 2 simplified dual 4Rx receiver compared to Type 1 Baseline 8Rx receiver Observation 3: Two CWs, i.e. more than 4 layers, can’t be supported by Type 2 simplified dual 4Rx receiverObservation 4: The performance gaps between two receiver types are very close to the simulation results span among companies, meanwhile, the results of Type 2 simplified dual 4Rx receiver are quite close to the farthest results from average in [2].Proposal 1: Use the alignment methodology used from NR UE Rel-15, i.e. 2.5dB span with removal of the farthest outlier from the average results.Proposal 2: Define two optional features without UE capability for these two different receiver implementation and two sets of requirements with corresponding test applicability rules as per such two optional UE features.  |
| R4-2402034 | ZTE | Observation 1. There are two different baseband implementations for Rank 4 applicable to UE support 8Rx.Proposal 2. Define two sets of requirements applicable to UE support Rank 4 when there are two different implementation methods. |
| R4-2401109 | Samsung | Observation 1: The results with impairments have much more span than the ideal results, as different impairment values from 1dB to 3dB are added.Proposal 1: Double check the results with impairments firstly and remove the farthest outlier from the average results.For the margin to be added on top of the averaged impairments results, we prefer to use option 3, and the value of x should be decided according to simulation results.Proposal 2: For 8Rx with rank 4 case, the margin to be added on top of the averaged impairments results, define two sets of requirements applicable to UE support of maxNumberMIMO-LayersPDSCH = 8 and maxNumberMIMO-LayersPDSCH = 4 respectively* Set A (maxNumberMIMO-LayersPDSCH=8): Add 0.8dB margin (the methodology used from NR UE Rel-15)
* Set B (maxNumberMIMO-LayersPDSCH=4): Add an additional margin on top of Set A results (e.g., 1.2dB); i.e., When UE supports maxNumberMIMO-LayersPDSCH=4, an additional x dB margin is added to the SNR requirement.
 |

## Open issues summary

### Sub-topic 1-1 Requirements for Rank4 test

**Issue 1-1-1: How to define the requirements for Rank4**

* *Background:*
	+ *Following options were discussed in RAN4#109 meeting:*

|  |
| --- |
| * *Rank4*
* *Option 1: Add 0.8dB margin for 64QAM (the methodology used from NR UE Rel-15)*
* *Option 2: Add 1.5dB margin for 64QAM*
* *Option 3: Define two sets of requirements applicable to UE support of maxNumberMIMO-LayersPDSCH = 8 and maxNumberMIMO-LayersPDSCH = 4 respectively*
	+ *Set A (maxNumberMIMO-LayersPDSCH=8): Add 0.8dB margin (the methodology used from NR UE Rel-15)*
	+ *Set B (maxNumberMIMO-LayersPDSCH=4): Add an additional margin on top of Set A results (e.g., 1.2dB); i.e., When UE supports maxNumberMIMO-LayersPDSCH=4, an additional x dB margin is added to the SNR requirement*
 |

* Proposals
	+ Option 1: Define two set of requirements applicable to UE support of different max MIMO layers, i.e. maxNumberMIMO-LayersPDSCH = 4 or 8. (Qualcomm, MTK, Nokia, Samsung)
		- Set A (maxNumberMIMO-LayersPDSCH=8): Add 0.8dB margin (the methodology used from NR UE Rel-15)
		- Set B (maxNumberMIMO-LayersPDSCH=4): Add an additional X dB margin on top of Set A results, i.e. (0.8 + X) dB
	+ Option 2: Define two set of requirements applicable to UE support of different 8Rx receiver for MIMO detector and add 0.8dB margin (the methodology used from NR UE Rel-15) (Ericsson, Huawei, ZTE, CTC)
		- Option 2a: Define optional without capability signalling UE feature for the following two different receiver implementations. (Huawei)
			* Type1: Baseline 8Rx receiver: MIMO detector with 8Rx
			* Type2: Simplified 8Rx receiver: UE performs two separate 4Rx MIMO detector and combines the LLR (Note that this receiver assumption can’t work for 8 layers)

* + Option 3: One set of requirements with 1.5dB margin for 64QAM on top of the averaged impairment results for PDSCH requirements derivation. (Apple)
* Recommended WF
	+ TBA.

**Issue 1-1-2: X value (If Option1 in Issue 1-1-1 is agreed)**

* Proposals
	+ Option 1: At least X=1.2dB (Qualcomm)
	+ Option 2: X=1.5dB (MTK)
	+ Others
* Recommended WF
	+ TBA

**Issue 1-1-3: How to align the ideal simulation results for Rank 4**

* *Background:*
	+ *Still very large span 3.7(TDD)/4.3(FDD) as per the results submitted by interesting companies for this meeting*
	+ *Following options were made in RAN4#109 meeting in the approved WF R4-2321199:*

|  |
| --- |
| ***How to align the ideal results**** *Proposals*
	+ *Option 1: Remove the farthest outlier from the average results (the methodology used from NR BS Rel-15)*
	+ *Option 2: Set the max allowed span to 3dB*
 |

* Proposals
	+ Option 1: Use 2.5dB max allowed span and remove the farthest outliers from the average results (used from NR Rel-15 UE demodulation requirements) (Huawei, Nokia, CTC, Ericsson, Samsung)
	+ Option 2: Relax the max allowed span to 3dB (MTK, Apple)
* Recommended WF
	+ This can be discussed after RAN4 finalizes the Issue 1-1-1.

### Sub-topic 1-2 Requirements for Rank8 test

**Issue 1-2-1: How to define the requirements for Rank8**

* *Background:*
	+ *Following options were made in RAN4#109 meeting:*

|  |
| --- |
| ***Margin to be added on top of the averaged impairment results for requirements derivation**** *Proposal*
	+ *Rank2 and Rank8*
		- *Add 0.8dB margin for 64QAM (the methodology used from NR UE Rel-15)*
 |

* Proposals
	+ Option 1: Add 0.8 margin (the methodology used from NR UE Rel-15) (Nokia)
* Recommended WF
	+ Agree Option1, i.e. 0.8dB additional margin on top of the average impairment results.

**Issue 1-2-2: How to align the ideal simulation results for Rank 8**

* *Background:*
	+ *As per the latest results submitted by interesting companies for this meeting*
		- *Results for TDD case are aligned with span 2.5dB*
		- *Results for TDD case is not aligned with span 2.7dB*
	+ *Following options were made in RAN4#109 meeting in the approved WF R4-2321199:*

|  |
| --- |
| ***How to align the ideal results**** *Proposals*
	+ *Option 1: Remove the farthest outlier from the average results (the methodology used from NR BS Rel-15)*
	+ *Option 2: Set the max allowed span to 3dB*
 |

* Proposals
	+ Option 1: Use 2.5dB max allowed span and remove the farthest outliers from the average results (used from NR Rel-15 UE demodulation requirements) (Huawei, Nokia, CTC, Ericsson, Samsung)
	+ Option 2: Relax the max allowed span to 3dB (MTK, Apple)
* Recommended WF
	+ TBA.

### Sub-topic 1-3 Requirements for Rank2 test

**Issue 1-3-1: How to define the requirements for Rank2**

* *Background:*
	+ *Ideal simulation results are aligned with 2.5dB span as per the latest results submitted by interesting companies for this meeting*
	+ *Following options were made in RAN4#109 meeting:*

|  |
| --- |
| ***Margin to be added on top of the averaged impairment results for requirements derivation**** *Proposal*
	+ *Rank2 and Rank8*
		- *Add 0.8dB margin for 64QAM (the methodology used from NR UE Rel-15)*
 |

* Proposals
	+ Option 1: Add 0.8 margin (the methodology used from NR UE Rel-15) (Nokia)
* Recommended WF
	+ Agree Option1, i.e. 0.8dB additional margin on top of the average impairment results.

# Topic #2: CA PDSCH requirements

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2400242 | Nokia, Nokia Shanghai Bell | 1. RAN4 could use TDLA 30-10 Low for defining requirements for CA for 8Rx Rank2 configurations.
2. RAN4 could use MCS 17 for defining requirements for CA for 8Rx Rank2 configurations.
 |
| R4-2400243 | Nokia, Nokia Shanghai Bell | Provide the simulation results |
| R4-2400422 | Apple | Proposal 3: Revisit Rank 2 from TDLC300-100 and MCS19 to TDLA30-10 Low and MCS17, as set in Rank 4 and Rank 8 tests in CA. |
| R4-2400423 | Apple | Provide the simulation results |
| R4-2400526 | MTK | Proposal 3: We slightly prefer to follow legacy CA requirements using ULA low channel to define rank2 CA requirements.Proposal 4: For CA requirements, we propose to use the following configuration for the number of HARQ process and K1 value.Number of HARQ process for 8Rx CA test

|  |  |  |
| --- | --- | --- |
| HARQ process number | CCs with the same duplex mode & SCS with Pcell | CCs with different duplex mode / SCS with Pcell |
| FDD 15 kHz + TDD 30 kHz CA | FDD PCell | 4 | 8 |
| TDD PCell | For CC with Rank 2: 10For CC with Rank 8: 8 | 8 |
| FDD 15 kHz + FDD 15 kHz CA | FDD PCell | 4 | N/A |
| TDD 30 kHz + TDD 30 kHz CA | TDD PCell | 8 | N/A |

K1 value for 8Rx CA test

|  |  |  |
| --- | --- | --- |
| The number of slots between PDSCH and corresponding HARQ-ACK information | CCs with the same duplex mode and SCS with Pcell | CCs with different duplex mode and/or SCS with Pcell |
| FDD 15 kHz + TDD 30 kHz CA | FDD PCell | {2} | {2} |
| TDD PCell | For CC with Rank 2: {8,7,6,5,5,4,3,11}For CC with Rank 8: {8,7,6,5,5,4,3} | {7,5,4,11,9} |
| FDD 15 kHz + FDD 15 kHz CA | FDD PCell | {2} | N/A |
| TDD 30 kHz + TDD 30 kHz CA | TDD PCell | For CC with Rank 2: {8,7,6,5,5,4,3,2}For CC with Rank 8: {8,7,6,5,5,4,3} | N/A |

 |
| R4-2400527 | MTK | Provide the simulation results |
| R4-2400729  | Qualcomm | Proposal2: RAN4 to use TDLC300-100 ULA medium B for Rank 2 8Rx CA test.  |
| R4-2400794 | CTC | Provide the simulation results |
| R4-2401109 | Samsung | Proposal 3: For 8Rx CA test with Rank 2, keep TDLC300-100 ULA Medium B (α = 0.3, β = 0.005154) that is same as Rank 2 single carrier test.Proposal 4: For 8Rx CA test, define test parameters for number of HARQ processes as below

|  |  |  |
| --- | --- | --- |
| HARQ process number | CCs with the same duplex mode & SCS with Pcell | CCs with different duplex mode / SCS with Pcell |
| FDD 15 kHz + TDD 30 kHz CA | FDD PCell | 4 | 8 |
| TDD PCell | For CC with Rank 2: 10For CC with Rank 8: 8 | 8 |
| FDD 15 kHz + FDD 15 kHz CA | FDD PCell | 4 | N/A |
| TDD 30 kHz + TDD 30 kHz CA | TDD PCell | 8 | N/A |

Proposal 5: For 8Rx CA test, define test parameters for K1 values as below

|  |  |  |
| --- | --- | --- |
| The number of slots between PDSCH and corresponding HARQ-ACK information | CCs with the same duplex mode and SCS with Pcell | CCs with different duplex mode and/or SCS with Pcell |
| FDD 15 kHz + TDD 30 kHz CA | FDD PCell | {2} | {2} |
| TDD PCell | For CC with Rank 2: {8,7,6,5,5,4,3,11}For CC with Rank 8: {8,7,6,5,5,4,3} | {7,5,4,11,9} |
| FDD 15 kHz + FDD 15 kHz CA | FDD PCell | {2} | N/A |
| TDD 30 kHz + TDD 30 kHz CA | TDD PCell | For CC with Rank 2: {8,7,6,5,5,4,3,2}For CC with Rank 8: {8,7,6,5,5,4,3} | N/A |

Observation 2: The SNR differences between the minimum and maximum bandwidths are no more than 1dB for both rank 2 and rank 8 scenarios.  |
| R4-2401553 | Ericsson | Proposal 2: Option 2: Keep TDLC300-100, ULA medium B and MCS19 that is same as rank 2 single carrier tests. |
| R4-2401554 | Ericsson  | Provide the simulation results |
| R4-2401668 | Huawei, HiSilicon  | Observation 5: A CR[5] was agreed in RAN4#105 meeting to modify the k1 value for S slot from 2 to 11 for CCs with the same duplex mode and SCS with Pcell for FDD 15 kHz + TDD 30 kHz CA with TDD PCell to comply with the restriction specified in 38.331 that up to 8 candidate k1 values can be configured in the RRC IE dl-DataToUl-ACK.Observation 6: There will be some scheduling problems if we set any k1 value making the HARQ RTT larger than HARQ processes. Proposal 3: For CA test with Rank2, RAN4 keeps to use TDLC300-100 ULA Medium B (α = 0.3, β = 0.005154) that is same as Rank 2 single carrier test.Proposal 4: Configure following k1 value:* FDD 15 kHz + TDD 30 kHz CA:
	+ For CC with Rank 2: {8,7,6,5,5,4,3,11}
	+ For CC with Rank 8: {8,7,6,5,5,4,3}
* TDD 30 kHz + TDD 30 kHz CA:
	+ For CC with Rank 2: {8,7,6,5,5,4,3,2}
	+ For CC with Rank 8: {8,7,6,5,5,4,3}

Proposal 5: Configure following HARQ processes number:* FDD 15 kHz + TDD 30 kHz CA:
	+ For CC with Rank 2: 10
	+ For CC with Rank 8: 8
* TDD 30 kHz + TDD 30 kHz CA: 8
 |
| R4-2401669 | Huawei, HiSilicon | Provide the simulation results |
| R4-2402034 | ZTE | Proposal 1. Keep TDLC300-100 ULA Medium B that is same as Rank 2 single carrier test for CA requirements.Proposal 3. Number of HARQ process and k1 value for TDD 30kHz SCS PCell + FDD 15kHz SCS SCell:- Rank 2 * 10 process with k1 value = {8,7,6,5,5,4,3,11}

- Rank 8 * 8 process with k1 value = {8,7,6,5,5,4,3}

Proposal 4. Number of HARQ process and k1 value for TDD 30kHz SCS PCell + TDD 30kHz SCS SCell:- Rank 2 * 8 process with k1 value = {8,7,6,5,5,4,3,2}

- Rank 8 * 8 process with k1 value = {8,7,6,5,5,4,3}
 |
| R4-2402035 | ZTE | Provide the simulation results |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1 Configuration for Rank 2 CA test

**Issue 2-1-1: Antenna correlation configuration for Rank2 CA test**

* *Background*
	+ *Following options were made in RAN4#109 meeting:*

|  |
| --- |
| * + *Option 1: Revisit Rank 2 to TDLA30-10 Low*
	+ *Option 2: Keep TDLC300-100 ULA Medium B (α = 0.3, β = 0.005154) that is same as Rank 2 single carrier test*
 |

* Proposals
	+ Option 1: Change the configuration to TDLA30-10 Low. (Apple, Nokia(slightly prefer), MTK(slightly prefer))
	+ Option 2: Keep TDLC300-100 ULA Medium B (α = 0.3, β = 0.005154) that is same as Rank 2 single carrier test. (Huawei, Samsung, Ericsson, ZTE)
* Recommended WF
	+ TBA

**Issue 2-1-2: MCS for Rank2 CA test**

* *Background:*
	+ *MCS 19 is agreed for Rank 2 single carrier test*
	+ *This is a new issue brought for this meeting, i.e. change MCS from MCS 19 to MCS 17 for Rank 2 test*
* Proposals
	+ Option 1: MCS17. (Apple, Nokia (slightly prefer))
	+ Option 2: Keep MCS19 that is same as Rank 2 single carrier test. (Huawei, Samsung, Ericsson, ZTE, CTC, MTK)
* Recommended WF
	+ TBA

### Sub-topic 2-2 Number of HARQ process and K1 value

**Issue 2-2-1: Number of HARQ processes**

* *Background*
	+ *In RAN4 #109 meeting, following options were made:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Number of HARQ process for 8Rx CA test**** *Proposal*

|  |  |  |
| --- | --- | --- |
| *HARQ process number* | *CCs with the same duplex mode & SCS with Pcell* | *CCs with different duplex mode / SCS with Pcell* |
| *FDD 15 kHz + TDD 30 kHz CA* | *FDD PCell* | *4* | *8* |
| *TDD PCell* | *Option 1: 8**Option 2:**For CC with Rank 2: 10**For CC with Rank 8: 8**Other options not precluded* | *8* |
| *FDD 15 kHz + FDD 15 kHz CA* | *FDD PCell* | *4* | *N/A* |
| *TDD 30 kHz + TDD 30 kHz CA* | *TDD PCell* | *Option 1: 8**Option 2:**For CC with Rank 2: 10**For CC with Rank 8: 8**Other options not precluded* | *N/A* |

 |

* Proposals
	+ Option 1: Use following number of HARQ process (MTK, Samsung, Huawei, ZTE)

|  |  |  |
| --- | --- | --- |
| HARQ process number | CCs with the same duplex mode & SCS with Pcell | CCs with different duplex mode / SCS with Pcell |
| FDD 15 kHz + TDD 30 kHz CA | FDD PCell | 4 | 8 |
| TDD PCell | For CC with Rank 2: 10For CC with Rank 8: 8 | 8 |
| FDD 15 kHz + FDD 15 kHz CA | FDD PCell | 4 | N/A |
| TDD 30 kHz + TDD 30 kHz CA | TDD PCell | 8 | N/A |

* Recommended WF
	+ Agree Option 1

**Issue 2-2-2: K1 value**

* *Background*
	+ *In RAN4 #109 meeting, following options were made:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***K1 value for 8Rx CA test**** *Proposal*

|  |  |  |
| --- | --- | --- |
| *The number of slots between PDSCH and corresponding HARQ-ACK information* | *CCs with the same duplex mode and SCS with Pcell* | *CCs with different duplex mode and/or SCS with Pcell* |
| *FDD 15 kHz + TDD 30 kHz CA* | *FDD PCell* | *{2}* | *{2}* |
| *TDD PCell* | *Option 1:* *For CC with Rank 2: {8,7,6,5,5,4,3,2}**For CC with Rank 8: {8,7,6,5,5,4,3}**Option 2:* *For CC with Rank 2: {8,7,6,5,5,4,3,11}**For CC with Rank 8: {8,7,6,5,5,4,3}**Other options not precluded* | *{7,5,4,11,9}* |
| *FDD 15 kHz + FDD 15 kHz CA* | *FDD PCell* | *{2}* | *N/A* |
| *TDD 30 kHz + TDD 30 kHz CA* | *TDD PCell* | *Option 1:* *For CC with Rank 2: {8,7,6,5,5,4,3,2}**For CC with Rank 8: {8,7,6,5,5,4,3}**Option 2:* *For CC with Rank2: {8,7,6,5,5,4,3,11}**For CC with Rank 8: {8,7,6,5,5,4,3}**Other options not precluded* | *N/A* |

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* Proposals
	+ Option 1: Use following K1 configuration (MTK, Samsung, Huawei, ZTE)

|  |  |  |
| --- | --- | --- |
| The number of slots between PDSCH and corresponding HARQ-ACK information | CCs with the same duplex mode and SCS with Pcell | CCs with different duplex mode and/or SCS with Pcell |
| FDD 15 kHz + TDD 30 kHz CA | FDD PCell | {2} | {2} |
| TDD PCell | For CC with Rank 2: {8,7,6,5,5,4,3,11}For CC with Rank 8: {8,7,6,5,5,4,3} | {7,5,4,11,9} |
| FDD 15 kHz + FDD 15 kHz CA | FDD PCell | {2} | N/A |
| TDD 30 kHz + TDD 30 kHz CA | TDD PCell | For CC with Rank 2: {8,7,6,5,5,4,3,2}For CC with Rank 8: {8,7,6,5,5,4,3} | N/A |

* Recommended WF
	+ Agree Option 1

# Topic #3: Others

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2400806 | China Telecom | Proposal 1: UE 8Rx PDSCH test requirements with interference scenarios should be introduced.Proposal 2: RAN4 to discuss if we can finish the UE 8Rx PDSCH test requirements with interference scenarios within Rel-18. |
| R4-2401058 | Apple | Observation 1: The UE requirements with inter-cell and intra-cell interference with 2RX and 4RX introduced in Rel-17 are mandatory for all UEs and release independent from Rel-15.Observation 2: During the 8RX UE demod scope discussion requirements with inter-cell and intra-cell interference were not included.Observation 3: We introduced PDSCH demod and CQI reporting requirements with inter-cell interference.Observation 4: The PDSCH demod requirements were introduced with 1 layer on target UE, with 1 and 2 interfering cells for homogeneous and heterogeneous networks.Observation 5: It is feasible to extend the inter-cell interference requirements to 8RX by keeping the same scope as Rel-17 requirements. Observation 6: For requirements with intra-cell interference, we introduced requirements with 1 co-scheduled UE, with 1+1 layer combination for 2x2, 2x4 and 2+2 for 4x4.Observation 7: It is feasible to extend the requirements with intra-cell interference to 8RX with the same scope. For example, requirements with 1 co-scheduled UE, with 1+1 layer combination for 2x8 and 2+2 for 4x8.Proposal 1: Discuss extending scope of Rel-18 8RX demod requirements to include requirements for inter-cell interference and intra-cell interference. Proposal 2: Keep the same test scope as Rel-17 inter-cell interference and intra-cell interference requirements for 8RX. |
| R4-2402277 | Nokia,Nokia Shanghai Bell, BT | For information:Observation 1: The PDSCH post-EQ SINR profiles, when using TDL channel models do not match measurements. SDM processing does not impact performance, when using TDL channel models. CDL both shows typical post-EQ SINR profiles and typical deployment spatial components.Observation 2: A span of per layer SINR which is in excess of 30dB is clearly demonstrated in both cases of the measurement campaign, with each spatial layer further exhibiting individual loss statistics.Proposal 1: Channel modelling utilised in performance requirement definitions for NR MIMO features should reflect similar variability in the quality of spatial layers as demonstrated in provided sample MIMO channel measurements.Observation 3: Analysis of SNR requirements for 70%TPUT and 2CW/8RX use case shows that TDL channel modelling cannot recreate post-EQ SINR profiles and different per CW performance/MCS that mimic MIMO deployments. CDL (the TR 38.827 version) mimics the MIMO effects and profiles the most closely and offers stable and repeatable performance levels.Proposal 2: Study the most appropriate method to add spatial channel modelling to performance requirements in Rel-19. The 8Rx/2CW use case analysed in this contribution can serve as alignment goal. |
| R4-2402774 | BT, Nokia, Nokia Shanghai Bell, Bell Mobility, CMCC, Deutsche Telekom, Ericsson, Intel, Orange, Telecom Italia, Telenor, Verizon, Vodafone, T-Mobile USA | [Observation 1: MNOs invest heavily in 5G NR MIMO systems, whilst performance requirements for MIMO features do not provide confidence in a universal minimum real-world performance.](#_Toc158045286)[Proposal 1: RAN4 to identify the most appropriate method to introduce spatial channel modelling to support MIMO performance requirements.](#_Toc158045287) |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1: Extension of scope

**Issue 3-1-1: Whether to extent the WI scope to include 8Rx PDSCH requirements with inter-cell and intra-cell inter user interference**

* *Background:*
	+ *In RAN#102, the was a discussion that further check if 8Rx PDSCH requirements with inter-cell and intra-cell inter user interference can be done in Rel-18 WI.*

|  |
| --- |
| *Summary/conclusions for Demodulation topics:** *UE performance requirements with inter cell and with intra-cell inter-use interference for 8Rx CPE/FWA/vehicle/industrial devices*
	+ *Further check if such objectives can be done in R18 performance*
 |

* Proposals
	+ Option 1: Extending the scope of Rel-18 8RX demod requirements to include requirements for inter-cell interference and intra-cell interference. (Apple, CTC)
	+ Other options.
* Recommended WF
	+ TBA.

**Issue 3-1-2: Test scope for 8Rx PDSCH requirements with inter-cell and intra-cell inter user interference if agreed**

* Proposals
	+ Option 1: Keep the same test scope as Rel-17 inter-cell interference and intra-cell interference requirements for 8RX. (Apple)
* Recommended WF
	+ TBA

# Topic #4: CR

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2400244 | Nokia | draftCR for 38.101 - inclusion of PDSCH CA Requirements  |
| R4-2400424 | Apple | draftCR on FRC for 8Rx UEs TDD 2 layers in CBW 5MHz to 30MHz  |
| R4-2400425 | Apple | draftCR on FRC for 8Rx UEs TDD 2 layers in CBW 40MHz to 100MHz |
| R4-2401108 | Samsung | Draft CR on 8Rx PDSCH demodulation requirements  |
| R4-2402546 | MTK | Draft CR to 38.101-4: FRC for 8Rx PDSCH requirements  |
| R4-2401667 | Huawei, HiSilicon | Draft BigCR Introduction of UE 8Rx performance requirements  |

# Topic #5 Documents and suggested status

|  |  |  |
| --- | --- | --- |
| **t-doc number** | **suggested status** | **comments** |
| [**R4-2400242**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400242.zip) | Noted |  |
| [**R4-2400243**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400243.zip) | Noted |  |
| [**R4-2400244**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400244.zip) | Revised | Add the reference channel as per other endorsed draft CRAdd the SNR value if possible |
| [**R4-2400422**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400422.zip) | Noted |  |
| [**R4-2400423**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400423.zip) | Noted |  |
| [**R4-2400424**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400424.zip) | Revised | Some updates are needed: “Number of consecutive PDSCH symbols”, “For Slot i, if mod(i, 10) = 7 for i from {0,…,39}”，“Number of DMRS REs”，and corresponding payload information bits and channel bits. |
| [**R4-2400425**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400425.zip) | Revised | Some updates are needed: “Number of DMRS REs”，and corresponding payload information bits and channel bits. |
| [**R4-2400526**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400526.zip) | Noted |  |
| [**R4-2400527**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400527.zip) | Noted |  |
| [**R4-2400729**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400729.zip) | Withdrawn | Conflict with R4-2402878, the proposals in [**R4-2402878**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402878.zip)should be considered? |
| [**R4-2400740**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400740.zip) | Noted |  |
| [**R4-2400793**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400793.zip) | Noted |  |
| [**R4-2400794**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400794.zip) | Noted |  |
| [**R4-2400806**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2400806.zip) | Noted |  |
| [**R4-2401058**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2401058.zip) | Noted |  |
| [**R4-2401108**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2401108.zip) | Revised | Update the SNR as per the latest results submitted for this meeting |
| [**R4-2401109**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2401109.zip) | Noted |  |
| [**R4-2401553**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2401553.zip) | Noted |  |
| [**R4-2401554**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2401554.zip) | Noted |  |
| R4-2401555 | Noted | Summary of simulation results, to be uploaded during this meeting |
| [**R4-2401668**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2401668.zip) | Noted |  |
| [**R4-2401669**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2401669.zip) | Noted |  |
| [**R4-2402034**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402034.zip) | Noted |  |
| [**R4-2402035**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402035.zip) | Noted |  |
| [**R4-2402277**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402277.zip) | Noted |  |
| R4-2402508 | Post-meeting email approval. | Big draft CR |
| [**R4-2402546**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402546.zip) | Agreed | Revision for draft of R4-2318668 endorsed in last RAN4#109 meeting after consideration the TRS overhead and no S slot scheduling for 8 layers |
| R4-2402652 | Noted | Moderator summary |
| [**R4-2402774**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402774.zip) | Noted |  |
| R4-2402857 | Approval | Way forward, needs to be approved at the end the meeting. |
| [**R4-2402878**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402878.zip) | Noted |  |