**3GPP TSG-RAN WG4 Meeting #94-e R4-2002380**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 6.12

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for RAN4#94e\_#89\_NR\_NewRAT\_Demod

**Document for:** Information

# Introduction

Definition of Rel-15 UE and BS NR demodulation requirements were finalized in RAN4 #93 meeting. The scope of this email thread is:

* Collect comments for CRs which contain corrections for Rel-15 requirements defined in TSs 38.101-4, 38.104, 38.141-1 and 38.141-2
* Discuss topics related to corrections/clarifications of Rel-15 requirements.

Email discussion targets for the 1st round and 2nd round

* 1st round:
  + Discuss proposals related to corrections/clarifications of Rel-15 requirements.
  + Collect comments for CRs which contain editorial corrections.
* 2nd round:
  + Collect comments for revised CRs from the 1st round.
  + Collect comments for CRs with changes related to agreements for open issues from Sections 1.2 and 2.2.
  + Collect comments for WFs (if needed)

# Topic #1: UE demodulation and CSI requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000076 | ANRITSU LTD | CR with the following changes for TS 38.101-4:   * Clarify “Precoding configuration” in Table 5.2-1 for PDSCH requirements. * Clarify “Precoding configuration” in Table 5.3-1 for PDCCH requirements. * In the PMI general description 6.3, clarify PDSCH random precoding. * In each PMI scenario, clarify Note 1 on Precoding configuration in Tables 6.3.2.x and 6.3.3.x. |
| R4-2000081 | ANRITSU LTD | CR with the following changes for TS 38.101-4:   * Table 5.3.3.1.2-1 Test 3 : Aggregation level is changed from 4 to 8 * Table 5.3.3.2-1 : Interleaversize=3 is specified (Aligned with corresponding 2RX TDD 2Tx test) * Table B.2.3.2.2-1: Typo corrected. |
| R4-2000353 | Qualcomm Incorporated | CR with the following changes for TS 38.101-4:   * Test cases for FR1 TDD Rank2 in Table 5.2.3.2.1-4 are corrected. * Precoding is specified for PDCCH in PDSCH test cases * Channel matrix is specified for HST single tap test cases |
| R4-2000358 | Intel Corporation | CR with the following changes for TS 38.101-4:   * Updated ‘pattern1’ and ‘pattern2’ parameter fields in tables with TDD configurations * Modified title for section A.1.3 from “TDD UL-DL configuration for FR2” to “TDD UL-DL configurations for FR2” to align with title naming for FR1 * Corrected unit for “Number of Code Blocks” in E-UTRA FRC tables * Removed row with “Maximum number of HARQ transmissions” configuration from several TDD FRC tables * Added missing units in Table A.3.2.2.2-8 * Aligned formatting for several rows in tables A.3.2.2.2-8 and A.3.2.2.5-8 |
| R4-2000564 | Rohde & Schwarz | **Proposal 1:** The SS-Block is mapped to one single physical antenna at Ref.1 as long as no beamforming is applied.  **Proposal 2:** Update the specification to include Table 3‑1 with the relevant information for each requirement with regard to Ref. 1.   |  |  |  |  | | --- | --- | --- | --- | | **Parameter** | **Unit** | **Value before applying channel matrix** | **Mapping to antenna before applying channel matrix** | | SSS transmit power | W | Test specific |  | | EPRE ratio of PSS to SSS | dB | 0 | PBCH transmitted over Single antenna | | EPRE ratio of PBCH to SSS | dB | 0 | | EPRE ratio of PBCH to PBCH DMRS | dB | 0 | | EPRE ratio of PDCCH to SSS | dB | 0 | PDCCH transmitted over same antenna as PBCH | | EPRE ratio of PDCCH to PDCCH DMRS | dB | 0 | | EPRE ratio of PDSCH DMRS to SSS | dB | Test specific | TC specific | | EPRE ratio of PDSCH to PDSCH DMRS | dB | Test specific (Note 1) | | EPRE ratio of CSI-RS to SSS | dB | Test specific (Note 2) | TC specific | | EPRE ratio of PDSCH OCNG to SSS | dB | Test specific (Note 3) | TC specific | | EPRE ratio of PDCCH OCNG to SSS | dB | 0 | Transmitted over same antenna as PBCH | | NOTE 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on “Number of DM-RS CDM groups without data” and “DMRS Type” parameters specified for each test.  NOTE 2: CSI-RS is not beamformed. Therefore in case of beamforming in general it will experience a gain from the channel matrix H which is different to the gain that a beamformed channel/signal will experience.  NOTE 3: NOTE 3: Since OCNG on different transmit antennas is always uncorrelated according to Annex A.5 it in general will experience a different power gain from the channel matrix H than PDSCH. This is because PDSCH on different transmit antennas might be correlated, e.g. in case of beamforming or Tx diversity. | | | |   Table 3‑1: Table proposed from R&S  **Proposal 3:** Add precoding matrix for PDSCH to each requirement to clarify mapping of antenna ports to physical antennas. |
| R4-2000565 | Rohde & Schwarz | CR with the following changes for TS 38.101-4:   * Updated tables C.3.1-1 and C.5.1-1. |
| R4-2001002 | MediaTek inc. | CR with the following changes for TS 38.101-4:   * In that test case, change the number of NZP CSI-RS ports from 2 to 4, in order to align with the antenna configuration ULA Low 4x4 |
| R4-2001450 | Huawei, HiSilicon | CR with the following changes for TS 38.101-4:   * Added the number of HARQ process 10 for 4Rx PDSCH Test 1-9 in Table 5.2.3.2.1-2; * Removed the left half square brackets. |

## Open issues summary

**Issue 1-1: SS-Block mapping to physical antennas**

* Background/Current status:
  + Rel-15 PBCH requirements are defined for scenarios with one Tx antenna
  + Mapping of SSS/PSS/PBCH to physical antennas is not specified for scenarios with number of Tx antenna higher than one.
* Proposals
  + Option 1: The SS-Block is mapped to one single physical antenna (R&S)
* Recommended WF
  + Collect companies views on option above.

**Issue 1-2: PDCCH mapping to physical antennas**

* Background/Current status:
  + Rel-15 PDCCH requirements are defined for the following precoding configuration: SP Type I, Random per slot with REG bundling granularity for number of Tx larger than 1.
  + PDCCH precoding configuration is not defined for PDSCH, SDR and CSI requirements.
* Proposals
  + Option 1: The PDCCH is mapped to one single physical antenna (R&S)
  + Option 2: Use precoding configuration from Rel-15 PDCCH requirements for PDSCH tests (QC)
* Recommended WF
  + Discuss whether we need to use Option 1 or Option 2 for PDSCH tests.
  + Discuss PDCCH precoding configuration for SDR and CSI tests
    - Note: For PDCCH we cannot modify previously agreed procedure for mapping to physical antennas, because it may lead to shit of SNR point.

**Issue 1-3: PDSCH mapping to physical antennas**

* Background/Current status:
  + PDSCH precoding granularity from Tables 5.2-1 and 7.2-1
    - FR1: SP Type I, Random per slot with PRB bundling granularity
    - FR2: SP Type I, Random per slot with Wideband granularity
  + Beamforming model is described in B.4.1.
* Proposals
  + Option 1: Add precoding matrix for PDSCH to each requirement to clarify mapping of antenna ports to physical antennas. (R&S)
* Recommended WF
  + Discuss whether we need to make additional clarifications in the existing PDSCH mapping procedure.

**Issue 1-4: DL channel signal power ratios**

* Background/Current status:
  + Power configurations for PDSCH, PDSCH DMRS, CSI-RS and OCNG are defined as

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| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| EPRE ratio of PDSCH to SSS | dB | 0 |
| EPRE ratio of PDSCH to PDSCH DMRS | dB | Test specific (Note 1) |
| EPRE ratio of CSI-RS to SSS | dB | 0 |
| EPRE ratio of OCNG to SSS | dB | 0 |
| Note 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on "Number of DM-RS CDM groups without data" and "DMRS Type" parameters specified for each test | | |

* Proposals
  + Option 1: Make the following modifications in configuration DL channel signal power ratios (R&S)

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| --- | --- | --- |
| **Parameter** | **Unit** | **Value before applying channel matrix** |
| EPRE ratio of PDSCH DMRS to SSS | dB | Test specific |
| EPRE ratio of PDSCH to PDSCH DMRS | dB | Test specific (Note 1) |
| EPRE ratio of CSI-RS to SSS | dB | Test specific (Note 2) |
| EPRE ratio of PDSCH OCNG to SSS | dB | Test specific (Note 3) |
| EPRE ratio of PDCCH OCNG to SSS | dB | 0 |
| NOTE 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on “Number of DM-RS CDM groups without data” and “DMRS Type” parameters specified for each test.  NOTE 2: CSI-RS is not beamformed. Therefore in case of beamforming in general it will experience a gain from the channel matrix H which is different to the gain that a beamformed channel/signal will experience.  NOTE 3: Since OCNG on different transmit antennas is always uncorrelated according to Annex A.5 it in general will experience a different power gain from the channel matrix H than PDSCH. This is because PDSCH on different transmit antennas might be correlated, e.g. in case of beamforming or Tx diversity. | | |

* Recommended WF
  + Discuss whether existing configuration leads to issue with different EPRE ratio of Phy channels / Reference signals before and after applying of channel matrix.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Qualcomm | Issue 1-1: Ok with Option 1 for PBCH requirements. However, we don’t understand why we need to clarify this since there is only 1 antenna configured in the test. We didn’t have to clarify this for PDCCH tests. What is so special in this case?  Issue 1-2: We prefer Option 2 to avoid any SNR issue with PDCCH decoding.  Issue 1-3: We are not sure why additional clarification is needed here based on our understanding in Issue 1-4.  Issue 1-4: In our opinion, after applying the channel matrix, signal should be normalized. So this issue of 6dB power difference in case of 4 ports should not happen. So, we should not modify this table. |
| R&S | Issue 1-1: To QC: We are not talking about PBCH requirements in our paper. In nearly all requirements there are multiple Tx antennas defined, but it is not clear how to map PBCH to these antennas. E.g. in a 4x2 case it is not clear if PBCH needs to be mapped to all 4 antennas or only to one, so therefor we need to clarify that PBCH is always mapped to only one antenna.  Issue 1-3: To QC: This clarification is needed in our view, since in the specification there is currently no mapping between logical and physical antennas in the requirements. Therefor it is unclear how, in this case PDSCH, the channel should be mapped. This is in our view also not related to Issue 1-4.  Issue 1-4: After applying the channel matrix only the sum of all signals and channels can be scaled, i.e. the power ratios of them cannot be changed anymore.  If e.g. the EPRE of PBCH (transmitted on one physical antenna) equals the EPRE of PDSCH (transmitted on 4 physical antennas) before the channel matrix, the EPRE of PBCH will be 6 dB below the PDSCH EPRE after the channel matrix.  In order to avoid this, you need to attenuate the PDSCH by 6 dB before the channel matrix, which needs to be specified in the table.  General comment: Our main point is that the values in the table should hold before the channel matrix, to solve these issues. |
| Intel | **Issue 1-1: SS-Block mapping to physical antennas**  We are fine with Option 1. Taking into account that SSB mapping to physical antennas are not clarified for tests with number on Tx antenna > 1 this information will be beneficial to avoid confusions in future. As for place in specification, where this clarification can be mentioned, we suggest to use Section B.4.1, which contains detailed description of mapping to physical antenna for different signals.  **Issue 1-2: PDCCH mapping to physical antennas**  For PDSCH, we prefer Option 2.  We think that Option 2 also can be used for SDR requirements.  As for CSI requirements, Option 2 should be fine for tests with number of Tx antenna less or equal to 4. Same time, Option 1 is more preferable for high number of Tx antenna, because random beamforming in Option 2 may lead to poor PDCCH performance which may affect overall test.  **Issue 1-3: PDSCH mapping to physical antennas**  We think existing information about PDSCH mapping is sufficient.  **Issue 1-4: DL channel signal power ratios**  We prefer to keep existing configuration. Based on our understand and calculation, there is no issue with different EPRE ration between signals before and after channel applying. Please find below our calculation to 2 Tx case: |

### CRs comments collection

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| **CR number** | **Comments collection** |
| R4-2000076 | Ericsson: Need to align with Qualcomm CR (R4-2000353), otherwise should be fine. |
| Qualcomm: In Table 5.3-1, we should still keep “with REG bundling granularity for number of Tx larger than 1.” at the end apart from the clarification added. |
| Intel: In Table 5.3-1, precoding configuration is for PDCCH, not PDSCH. Therefore, content in parameter column should be corrected and configuration should be kept unchanged, as suggested by QC. |
| R4-2000081 | Ericsson: That is not a typo, should be different aggregation levels for 2Rx, and 4Rx. See R4-1902406. |
| Qualcomm: For change in Table 5.3.3.1.2-1, based on agreed simulation assumptions, it should be Aggregation level 4. If reference channel is not correct, it should be corrected accordingly. |
| Huawei: As per the approved WF for NR PDCCH R4-1902406, AL for case#13: 8 for 2Rx and 4 for 4Rx, so the updates to Table 5.3.3.1.2-1 Test 3 : Aggregation level is changed from 4 to 8 is not needed. |
| R4-2000353 | Ericsson: Using wrong font, should be Arial, not Times New Roman for Table 5.5A-1 Also need to align with Anritsu CR (R42000076) for wording preference. |
| Huawei: It is not necessary to give further clarification about the static channel for HST single tap related test cases, the existing propagation conditions of HST-750 and HST-1000 are clear enough. |
| Intel: We agree with comment from HW, i.e. note with information about static channel model is not required for HST channel model, because this information is already provided in Section B.3.1. |
| R4-2000358 | Qualcomm: Looks ok. |
| Huawei:  - As per TS 38.331, pattern1 is mandatory and pattern2 is optional, so option2 is not needed to be specified for DCI-based dynamic UL/DL detection configuration like did in Table A.1.2-1;  - Note 4 in Table A.1.2-2a and Table A.1.3-2a for dynamic UL/DL detection needs to be udpated *tdd-UL-DL-semi-statically* -> *tdd-UL-DL-ConfigurationCommon*  *-* No unit is needed for “Number of Code Blocks”, just remove the current unit of “Bits” |
| Intel: Reply to Huawei comments  - Information about pattern 1 and pattern 2 with values N/A in Table A.1.2-2a is just to highlight that this information is not provided to UE during the test. If it is OK for all companies then we can remove pattern2 configuration from this table,  - Ok  - In all other FRCs unit “CBs” is used for “Number of Code Blocks”, therefore we suggest to make such changes to have aligned format with other tables. |
| R4-2001002 | Qualcomm: Looks ok. |
| R4-2001450 | Qualcomm: Looks ok. |

## Summary for 1st round

### Open issues

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| **Status summary** |
| **Issue 1-1: SS-Block mapping to physical antennas**  Tentative agreements: The SS-Block is mapped to one single physical antenna  **Issue 1-2: PDCCH mapping to physical antennas**  Tentative agreements:   * PDSCH requirements: Use precoding configuration from Rel-15 PDCCH requirements * SDR requirements: Use precoding configuration from Rel-15 PDCCH requirements   Candidate options:   * CSI requirements:   + Option 1: Use precoding configuration from Rel-15 PDCCH requirements   + Option 2: The PDCCH is mapped to one single physical antenna   Recommendations for 2nd round: Further discuss PDCCH mapping for CSI requirements  **Issue 1-3: PDSCH mapping to physical antennas**  Candidate options:   * Option 1: Add precoding matrix for PDSCH to each requirement to clarify mapping of antenna ports to physical antennas (R&S) * Option 2: Additional clarifications are not needed (QC, Intel)   Recommendations for 2nd round: Proponents of Option 1 are encouraged to provide more details on what kind of clarifications are needed  **Issue 1-4: DL channel signal power ratios**  Candidate options:   * Option 1: Modification of existing DL channel signal power ratios configuration is needed (RS) * Option 2: Existing DL channel signal power ratios configuration is fine (QC, Intel)   Recommendations for 2nd round: Further discuss two options above. |

### CRs

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| **CR number** | **CRs/TPs Status update recommendation** |
| R4-2000076 | To be revised |
| R4-2000081 | To be revised |
| R4-2000353 | To be revised |
| R4-2000358 | To be revised |
| R4-2001002 | Agreeable |
| R4-2001450 | Agreeable |

## Discussion on 2nd round

### Open issues

**Issue 1-2: PDCCH mapping to physical antennas (CSI requirements)**

* Proposals
  + Option 1: Use precoding configuration from Rel-15 PDCCH requirements
  + Option 2: The PDCCH is mapped to one single physical antenna
* Recommended WF: Collect companies views on two options above

**Issue 1-3: PDSCH mapping to physical antennas**

* Proposals
  + Option 1: Add precoding matrix for PDSCH to each requirement to clarify mapping of antenna ports to physical antennas (R&S)
  + Option 2: Additional clarifications are not needed (QC, Intel)
* Recommended WF:
  + Collect more companies views on two options above
  + Proponents of Option 1 are encouraged to provide more details on what kind of clarifications are needed

**Issue 1-4: DL channel signal power ratios**

* Proposals
  + Option 1: Modification of existing DL channel signal power ratios configuration is needed (RS)
  + Option 2: Existing DL channel signal power ratios configuration is correct (QC, Intel)
* Recommended WF: Collect more companies views on two options above

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| **Company** | **Comments** |
| R&S | Issue 1-2:  Issue 1-3: In our understanding, in the current specification there is no indication how to map the PDSCH to different Tx antennas. Take for example a TC with a 2 layer PDSCH transmission, however the antenna configuration is 4x2, currently it is not defined in the spec how to map the PDSCH to the four antennas. This should be clarified, otherwise we might see different implementations.  Issue 1-4: To Intel: In your example the matrix W does the job of the required PDSCH attenuation.  This matrix is taken out of TS 38.214 and is only applicable in case of CSI reporting.  If there is no CSI reporting and there is no PDSCH precoding defined otherwise (as in  TS 38.101-4 ) then W will be equal to the identity matrix, i.e.  and thus we will have : while |
| Intel | Issue 1-2: Prefer Option 2, based on our comments from 1st round discussion  Issue 1-3/1-4: From Annex B.4.1 in TS 38.101-4: The precoder matrix W(i) is specific to the test case configuration. Precoding configuration is defined for each demodulation test. At current stage, SP Type I is used for the most of test cases. List of possible precoders for SP Type I is defined in Section 5.2.2.2.1 of TS 38.214 and these precoders were used for results collection from different companies. Therefore, based on our understanding, using of this precoders allows to clarify mapping of 2 layers PDSCH for 4 Tx antenna and allows to avoid any issues with EPRE ratios.  Same time, probably, it is not clear from TS 38.101-4 that precoders from TS 38.214 are used for PDSCH requirements. Therefore, we can fix it this or next RAN4 meeting. |
| Qualcomm | Issue 1-2: Prefer Option 1 because we used random precoding for defining PDCCH performance tests with number of Tx greater than 1 and we don’t want to have different assumption for other test cases.  Issue 1-3/1-4: Similar view as Intel. One question to Intel: When you say it is not clear that precoders are from 38.214, I am not sure what you mean. We clearly say in Table 5.2-1 that we are using single panel type I precoders and that are only defined in 38.214. Are you suggesting to add reference to 38.214 in Table 5.2-1 precoding configuration? |
| Anritsu | Issues related to precoding of PDSCH and PDCCH:  > For Anritsu R4-2000076, propose to merge Table 5.2-1 change 1 from Qualcomm R4-2000353 into Anritsu CR and align the wording, to address comments from Ericsson and Qualcomm. Also update Table 5.3-1 to address comments from Qualcomm and Intel.  This update is available as “draft updated R4-2000076 FR1 Random PMI 38.101-4 CR\_Rel-15\_v1”  > For Qualcomm R4-2000353, propose to remove Table 5.2-1 change 1 from this CR, as it can be merged into the update of Anritsu R4-2000076 as above. Then, align Table 5.5A-1 change 7 to align the wording, to address comments from Ericsson.  A proposal for this update is available as “draft Anritsu-updated R4-2000353\_CR\_Corrections\_FR1\_PDSCH proposal”.  Both drafts have been uploaded to <https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e> /Inbox/Drafts/%2389\_NR\_NewRAT\_Demod |
| Anritsu | Issues related to PDCCH aggregation level in R4-2000081:  Updated the Reference channel to align with the stated aggregation level (not the other way round), based on first round feedback from Ericsson, Qualcomm and Huawei to align with simulation assumptions in R4-1902406.  This update is available as “R4-2000081\_38.101-4\_Cat F\_Rel-15\_Demod\_PDCCH 2Tx4Rx\_S25”, uploaded to <https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e> /Inbox/Drafts/%2389\_NR\_NewRAT\_Demod |
| Intel | Issue 1-3/1-4: Reply to QC: Yes, probably it is better to add reference to 38.214 to avoid confusion. As for place, reference can be added in Section B.4.1 to avoid multiple references in multiple places. |
| Qualcomm | Issue 1-1: Regarding the tentative agreement on SSB mapping, we think that other TE vendors should also provide inputs before we agree to it. |

### CRs comments collection

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| **CR number** | **Comments collection** |
| R4-2002446 (Revision of R4-2000076) |  |
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| R4-2002447 (Revision of R4-2000081) |  |
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| R4-2002448 (Revision of R4-2000353) | Qualcomm:  Question to Intel and Huawei: I don’t see any reference to Annex B.1 in the description of HST single tap channel model in Annex B.3.1, so I am not sure how it is clear to a reader outside of 3gpp standards group that we are supposed to use static channel matrix for HST single tap. So, as of now, I have not removed note to Annex B.1 in the revision. |
| Intel:  Based on our understanding this information is captured in the following sentences in B.3.1:  For 1x2 antenna configuration, the same *h*(*t*,τ) is used to describe the channel between every pair of Tx and Rx. For 1x4 antenna configuration, the same *h*(*t*,τ) is used to describe the channel between every pair of Tx and Rx.  Same time, if any clarifications are needed for Single Tap HST model, I suggest to add such clarifications in Section B.3.1 instead of adding of Notes for each test. |
|  |
| R4-2002449 (Revision of R4-2000358) | Qualcomm: We would suggest to mimic the changes in Table A.1.2-2a to Table A.1.3-2a as well, so that they are consistent with each other. |
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| R4-2000565 |  |
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## Summary on 2nd round

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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: BS demodulation requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000295 | Samsung | CR with the following changes for TS 38.141-1:   * Missing CSI part 2 in section 8.2.3.1 * Space missing in section 8.2.3.1 * Fix the typos in section 8.2.3.1 |
| R4-2000297 | Samsung | CR with the following changes for TS 38.141-2:   * Space missing in section 8.2.3.1 * Fix the spelling typos in section 8.2.3.4.2, Space missing in section 8.2.3.4.2 * Fix the spelling typos in section 8.2.3.5.2 and FRC table index |
| R4-2001172 | Ericsson | CR with the following changes for TS 38.104:   * Intra-slot frequency hopping parameter is set to N/A when there’s only 1 OFDM symbol allocated for short PUCCH (format 0 and format 2). |
| R4-2001174 | Ericsson | CR with the following changes for TS 38.141-1:   * Intra-slot frequency hopping parameter is set to N/A when there’s only 1 OFDM symbol allocated for short PUCCH (format 0 and format 2). |
| R4-2001176 | Ericsson | CR with the following changes for TS 38.141-2:   * Intra-slot frequency hopping parameter is set to N/A when there’s only 1 OFDM symbol allocated for short PUCCH (format 0 and format 2). |
| [R4-2001451](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2001451.zip) | Huawei, HiSilicon | **Observation 1:** No specific HARQ timing defined for NR BS demodulation performance tests  **Proposal 1:** Perform the NR BS demodulation conformance testing as following:   * TE firstly generates a fixed data sequence with 0, 1 symbol as per the payload size defined in the FRC for each test   **Option 1:**   * BS schedules the PUSCH transmission in a fixed periodicity, such as 5ms, by only indicating different RV sequence {0,2,3,1} to TE every time; * TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise * TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission   **Option 2:**   * BS schedules the PUSCH transmission in any available DL slots before the following first available UL slots with one HARQ process, only schedule the first UL slot if more than one consecutive UL slots * TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise * TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission |

## Open issues summary

**Issue 2-1: NR BS demodulation conformance testing**

* Background/Current status:
  + No specific HARQ timing defined for NR BS demodulation performance tests and definition of HARQ procedure for conformance testing is required.
* Proposals
  + Option 1 (HW):
    - TE firstly generates a fixed data sequence with 0, 1 symbol as per the payload size defined in the FRC for each test
    - BS schedules the PUSCH transmission in a fixed periodicity, such as 5ms, by only indicating different RV sequence {0,2,3,1} to TE every time;
    - TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise
    - TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission
  + Option 2 (HW):
    - TE firstly generates a fixed data sequence with 0, 1 symbol as per the payload size defined in the FRC for each test
    - BS schedules the PUSCH transmission in any available DL slots before the following first available UL slots with one HARQ process, only schedule the first UL slot if more than one consecutive UL slots
    - TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise
    - TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission
* Recommended WF
  + Collect companies views on options above. Identify if there any other options for this issue.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Keysight | Issue 2-1: We don’t believe this much detail is not necessary defined in conformance test procedure. It’s too much detail to be described. We should leave this level of detail for each individual implementation. LTE spec doesn’t have this much detail in procedure.  Regarding with number of HARQ processes, if it’s the case that this still needs to be defined, then it should be more than one whenever more processes possible to fill all UL slots in some cases like FDD. |
| Nokia, Nokia Shanghai Bell | Issue 2-1: Nokia does not think that capturing more detail is needed in the specification to allow for reproducible and consistent testing. Hence, we propose option 3: No change. Currently the HARQ feedback is provided to the TE via an error free side link (See e.g., 38.141-1 D.5.1). Since the TDD/FDD pattern is known, the TE applies RV feedback received in a test implementation specific timing window to the corresponding TB. No further information and specification is required. We assume that each TB and its retransmission contain the same payload. The payload per TB is randomized. |
| Ericsson | We checked some time ago and did not find any performance differences relating to HARQ timing. We agree that the test can be implemented with the level of detail currently provided by the specification and do not see a need to add anything new. |
| Huawei | NR is asynchronous system that is different from LTE, we agree that no performance difference relating to HARQ timing, but the test methodology between gNB and TE may be different for different TE vendors and gNB needs to cate for different test method with different TEs that increase the test cost, also different gNB has different test methods. |
| China Telecom | Tend to agree with Nokia and Ericsson.  HARQ timing can be different for different duplex modes and TDD patterns, and it is difficult to capture it in a unified approach. |

### CRs comments collection

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| **CR number** | **Comments collection** |
| R4-2000295 | Nokia, Nokia Shanghai Bell:  It was Nokia’s understanding that non-essential corrections are no longer allowed for Rel-15. While the typos corrected in this CR are sometimes close to obscuring meaning, the spec should still be unambiguous for the specialist reader. Hence, only the R16 version of this CR should be agreeable.  For the R15 version, the opinion of MCC would need to be obtained. |
| R4-2000297 | Nokia, Nokia Shanghai Bell: Same as for R4-2000295. |
| R4-2001172 | Nokia, Nokia Shanghai Bell:  The contradiction in RRC configuration, treated by this CR, is currently being addressed in RAN2 directly (see for example R2-2000166). RAN4 should wait for the outcome of RAN2 and, in particular, should not capture assumptions in the specification that might be contradicted by expected bugfixes in RAN2.  As a side note: The configuration chosen by RAN4 is a valid R15 RRC configuration, hence the UE must be able to deal with it and not RRC rejection is allowed. |
| Ericsson: The rationale here is that currently the test configuration states in some places that both 1 symbol and frequency hopping is enabled. We see this as an error because there is an ambiguity as to whether what is meant is (i) do 2 symbols and hopping or (ii) do not do hopping.  Presumably even if the RRC configuration is valid, it is not clear how the UE deals with it right now. If RAN2 makes the fix, then it may be possible to read the test spec, read the RAN2 spec and deduce what is the expected configuration (although that would break the principle of test specs being self-contained). Our understanding is that the intention in the RAN4 spec is anyhow to configure 1 slot and no hopping as opposed to configure both 1 slot and hopping and then rely on the RAN2 behavior. |
| Huawei: As per TS 38.331, the *intraSlotFrequencyHopping* is optional. If it is not applicable, it should not configured.    RAN2 CR that Nokia mentioned is related to if the network configure the *intraSlotFrequencyHopping* to UE that does not support FH or with 1 symbol, actually this is a wrong network behavior, RAN2 can give some clarification, but during RAN4 conformance testing, we do not need to configure all frequency hopping related, inclduing *intraSlotFrequencyHopping,* *secondHopPRB* and hopping id for 1 symbol cases. |
| R4-2001174 | Nokia, Nokia Shanghai Bell: Same as for R4-2001172. |
| R4-2001176 | Nokia, Nokia Shanghai Bell: Same as for R4-2001172. |

## Summary for 1st round

### Open issues

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| **Status summary** |
| **Issue 2-1: Details of HARQ timing for NR BS demodulation conformance testing**  Candidate options:   * Option 1: Define the details of HARQ timing for NR BS demodulation conformance testing (Huawei) * Option 2: Don’t define the details of HARQ timing for NR BS demodulation conformance testing (Keysight, Nokia, Ericsson, China Telecom)   Recommendations for 2nd round: Further discuss two options above.  **(New) Issue 2-2: Intra-slot frequency hopping configuration for short PUCCH requirements with 1 symbol allocation**  Candidate options:   * Option 1: Not configure intra-slot frequency hopping related configurations by setting to N/A (Ericsson, Huawei) * Option 2: Keep current configuration (Nokia)   Recommendations for 2nd round: Further discuss two options above. |

### CRs

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| **CR number** | **CRs/TPs Status update recommendation** |
| R4-2000295 | Agreeable in case Rel-15 CR with non-essential corrections is acceptable for this meeting. |
| R4-2000296 | Agreeable (Rel-16 Cat A CR of R4-2000295) |
| R4-2000297 | Agreeable in case Rel-15 CR with non-essential corrections is acceptable for this meeting. |
| R4-2000298 | Agreeable (Rel-16 Cat A CR of R4-2000297) |
| R4-2001172 | Return to this CR once agreement on Issue 2-2 will be reached. |
| R4-2001173 | Return to (Rel-16 Cat A CR of R4-2001172) |
| R4-2001174 | Return to (Same changes as in R4-2001172 for TS 38.141-1) |
| R4-2001175 | Return to (Rel-16 Cat A CR of R4-2001174) |
| R4-2001176 | Return to (Same changes as in R4-2001172 for TS 38.141-2) |
| R4-2001177 | Return to (Rel-16 Cat A CR of R4-2001176) |

## Discussion on 2nd round

### Open issues

**Issue 2-1: Details of HARQ timing for NR BS demodulation conformance testing**

Proposals:

* Option 1: Define the details of HARQ timing for NR BS demodulation conformance testing (Huawei)
* Option 2: Don’t define the details of HARQ timing for NR BS demodulation conformance testing (Keysight, Nokia, Ericsson, China Telecom)

Recommended WF: Collect more companies views on options above.

**Issue 2-2: Intra-slot frequency hopping configuration for short PUCCH requirements with 1 symbol allocation**

Proposals:

* Option 1: Not configure intra-slot frequency hopping related configurations by setting to N/A (Ericsson, Huawei)
* Option 2: Keep current configuration (Nokia)

Recommended WF: Collect more companies views on options above.

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| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | Issue 2-1: As Huawei has replied in the 1st round comments, this is not a question on performance but implementation of conformance test mode. RAN4 should not force a certain implementation between BS and TE vendor; especially not this late in Rel-15 where most of these conformance tests have been finished. We have even outlined a possible conformance test implementation in the first round. Thus we chose option 2, which means no change.  Issue 2-2: At least we need to wait for the outcome of the discussion in RAN2 (around the R2-2000166). We should not anticipate their decision and capture some potentially wrong behavior (even though the way forward in RAN2 should follow logic). We disagree with Huawei’s statement that “if the network configure the *intraSlotFrequencyHopping* to UE that does not support FH or with 1 symbol, actually this is a wrong network behavior”. This is allowed behavior according to RRC specification, the UE may not reject RRC configuration based on such a configuration. Since it is not a wrong configuration and it is logically very clear how the configuration is to be taken, we see the CRs as non-essential clarifications. Hence, this clarification should not be included in Rel-15. For Rel-16 we also don’t see a need, but we could compromise. |
| Ericsson | Issue 2-1: We also think that this is a detail of the test setup that does not impact performance, and it is OK to leave the spec as it is.  Issue 2-2: I don’t quite follow what we are waiting for from RAN2… the RAN4 requirement has been derived assuming 1 symbol and no frequency hopping. So in the RAN4 spec, we need to configure 1 symbol and no frequency hopping so that the requirement and test setup is properly captured. If we write it that way then we have no dependency on RAN2. In fact, if RAN2 would reach a different decision on how to handle the conflicting configuration then we would have a problem because the RAN4 test spec would, read together with RAN2 specs imply a different setup to the one the requirement was derived for. Also, in general, our understanding is that the test specifications are meant to be as far as possible self-contained, i.e. do not need reading together with other specs. |
| Keysight | Issue 2-1: We also support Option 2, not to specify implementation details in conformance specification.  Issue2-2: We support point raised original CR from ericsson, which is to clarify the case of 1 symbol. We actually received question, while Test Parameter says Intra-slot frequency hopping enabled, but there are cases which only 1 symbol in slot. There is no way to hop. This maybe obvious for people discussed about this part of specification but somewhat confusing. |

### CRs comments collection

*Moderator recomendations: Based on 1st round discussion, techical issue for CRs in this section is related to Issue 2-2. Please use table below to provide comments not related to Issue 2-2 (i.e. typos/corrections for other changes in these CRs) and use table in Section 2.5.1 to provide comments on Issue 2-2. Conclusion will be made based on outcome of discussion in both sections (2.5.1 and 2.5.2).*

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| **CR number** | **Comments collection** |
| R4-2001172 |  |
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| R4-2001174 |  |
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| R4-2001176 |  |
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### WFs comments collection

List of WFs

* R4-2002445 Way forward on HARQ timing for NR BS demodulation conformance testing, Huawei

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| **WF number** | **Comments collection** |
| R4-2002445 |  |
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## Summary on 2nd round

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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”* |