**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**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

|  |  |  |
| --- | --- | --- |
| **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

|  |  |  |
| --- | --- | --- |
| **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)

|  |  |  |
| --- | --- | --- |
| **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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | Issue 1-1:Issue 1-2:Issue 1-3:Issue 1-4: |
| Company B | Issue 1-1:Issue 1-2:Issue 1-3:Issue 1-4: |

### CRs comments collection

|  |  |
| --- | --- |
| **CR number** | **Comments collection** |
| R4-2000076 | Company A |
| Company B |
|  |
| R4-2000081 | Company A |
| Company B |
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| R4-2000353 | Company A |
| Company B |
|  |
| R4-2000358 | Company A |
| Company B |
|  |
| R4-2001002 | Company A |
| Company B |
|  |
| R4-2001450 | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs

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| --- | --- |
| **CR 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 (if applicable)

## Summary on 2nd round (if applicable)

|  |  |
| --- | --- |
| **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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A |  |
| Company B |  |

### CRs comments collection

|  |  |
| --- | --- |
| **CR number** | **Comments collection** |
| R4-2000295 | Company A |
| Company B |
|  |
| R4-2000297 | Company A |
| Company B |
|  |
| R4-2001172 | Company A |
| Company B |
|  |
| R4-2001174 | Company A |
| Company B |
|  |
| R4-2001176 | Company A |
| Company B |
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## Summary for 1st round

### Open issues

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| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs

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| --- | --- |
| **CR 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 (if applicable)

## Summary on 2nd round (if applicable)

|  |  |
| --- | --- |
| **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”* |