**3GPP TSG-RAN WG4 Meeting #94-e Draft R4-2002514**

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

**Agenda item:** 7.10.4

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for RAN4#94e\_#85\_LTE\_eMTC5\_Demod

**Document for:** Information

# Introduction

This email discussion targets to sort out open issues on the UE demodulation/CSI reporting requirements and BS demodulation requirements for Rel-16 eMTC.

This email discussion also targets to agree with the simulation assumption of improved MPDCCH with CRS+DMRS and CSI-RS based CSI reporting test.

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

* 1st round: Collect companies view on the open issues
* 2nd round: Sort out open issues. Agree with the simulation assumption for MPDCCH and CSI-RS based CSI reporting test

File name rule from moderator: RAN4#94e\_#85\_LTE\_eMTC5\_Demod\_<mm><dd><hh>UTC

# Topic #1: Open issues on UE/BS demodulation requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| T-doc number | Company | Proposals / Observations |
| R4-2000311 | Samsung | **Proposal 1:** No new BS requirement for PUSCH with continuous multi-TB scheduling**Proposal 2:** No new BS requirement for PUSCH with interlace multi-TB scheduling |
| R4-2001351 | Ericsson | **Proposal 1:** RAN4 does not define new PDSCH demodulation requirements with multi-TB scheduling.**Proposal 2:** RAN4 does not define new PUSCH demodulation requirements with multi-TB scheduling.**Proposal 3:** RAN4 does not define new MPDCCH/PDSCH demodulation requirements with the use of LTE control region.  |
| R4-2001479 | Huawei, HiSilicon | **Proposal 1:** Define performance requirements for multi-TB scheduling for PUSCH in additional MTC enhancement |
| R4-2001480 | Huawei, HiSilicon | **Proposal1:** Define performance requirements for multi-TB scheduling of PDSCH in additional MTC enhancement**Proposal2:** Not to define new performance requirements for transmission on LTE control region |
| R4-2001915 | Nokia, Nokia Shanghai Bell | **Proposal 1:** No separate UE / BS demodulation requirements are required for multi-TB scheduling for PDSCH / PUSCH. **Proposal 2:** RAN4 should liaise with RAN1 to receive guidance on relevant performance evaluation scenarios, i.e. assumptions on the configuration of resources and related PHY layer parameters for MPDCCH and PDSCH, for evaluating the performance gain for the feature ‘use of LTE control region in LTE-M standalone deployment’.**Proposal 3:** RAN4 should specify demodulation requirements for MPDCCH using DMRS and CRS, for both modes precoder cycling and CSI feedback. **Proposal 4:** RAN4 should specify CSI reporting requirements for CSI-RS based feedback only for single layer transmission to non-BL UEs in CE mode A. |

## Open issues summary

### Sub-topic 1-1: Whether to define PUSCH demodulation requirements with multi-TB scheduling

**Issue 1-1: Define PUSCH demodulation requirements?**

* Proposals
	+ Option 1: No (Samsung, Ericsson, Nokia, Nokia, Shanghai Bell)
	+ Option 2: Yes (Huawei, HiSilicon)
* Recommended WF
	+ More discussion needed

### Sub-topic 1-2: Whether to define PDSCH demodulation requirements with multi-TB scheduling

**Issue 1-2: Define PDSCH demodulation requirements?**

* Proposals
	+ Option 1: No (Ericsson, Nokia, Nokia, Shanghai Bell)
	+ Option 2: Yes (Huawei, HiSilicon)
* Recommended WF
	+ More discussion needed.

### Sub-topic 1-3: Whether to define MPDCCH/PDSCH demodulation requirements using LTE control region

**Issue 1-3: Define MPDCCH/PDSCH demodulation requirements?**

* Proposals
	+ Option 1: No (Ericsson, Huawei, HiSilicon)
	+ Option 2: Liaise with RAN1 to receive guidance on relevant performance evaluation scenarios (Nokia, Nokia, Shanghai Bell)
* Recommended WF
	+ No new MPDCCH/PDSCH demodulation requirements for the transmission on LTE control region.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| Company | Comments |
| Qualcomm | Sub topic 1-1: Sub topic 1-2: We support Option 1. Multi-TB scheduling has no new PHY impact or UE behavior that needs to be tested.Sub topic 1-3: We agree with the WF.  |
| Huawei, HiSilicon | Sub topic 1-1: We think that since RAN1 has verified the performance of 8 interlaced TB and substantial gain can be achieved, it is very important for RAN4 to define related requirements. For the receiver, the PHY layer refinements may refer to the changes of buffer size for interleaved TBs.Sub topic 1-2: Multi-TB in UE/BS side, timing diversity gain when using interleaved multi-TB scheduling can be captured based on our simulation results.Sub topic 1-3: Since no company in this meeting proposes to define requirements for transmission in LTE control region, we think there is no need to further discuss this issue. |
| Samsung | Sub topic 1-1: Issue 1-1: Define PUSCH demodulation requirements?Prefer option 1: No PUSCH demodulation requirements with multi-TB schedulingThe multi TB transmission can be continuous or discontinuous.Since each TB has individual HARQ process, the demodulation performance of each TB should be similar. Therefore, there is no new requirement for continuous multi-TB scheduling. Regarding interlaced TB scheduling, the diversity gain depends on the multi-TB. RAN1 have verified the substantial gain achieved with 8 interlaced TB. While in case of small number TB scheduling, the diversity gain is limited and will be reduced significantly.Considering the complexity, data processing, buffer issue, RAN4 should focus on the typical scenario for requirement with multi-TBAs agreed in RAN1, for unicast in CE mode A, at least for 1-2 TBs scheduling with a single DCI is supported without new restriction on MCS, Therefore, the diversity gain is limited.Meanwhile, the interleaving granularity configuration for indication multi-TB is similar the invalid subframe indication with 16 bitmap in LTE rel-13. In case of invalid UL subframe configured, UE will postpone PUSCH transmission, there is no impact on the BS receiver processing.In terms of demodulation performance for each TB, we do not think there is too much different with the non-continuous transmission in time domain with invalid subframe indication configuration in FDD and the UL-DL configuration in TDD. Therefore, there is no new requirement for interlaced TB scheduling |
| Ericsson | Sub topic 1-1: We prefer option 1. From the PUSCH demodulation we don’t see any difference between the multi-TB allocation and the Rel-13 single TB allocation. Since BS continuously receives the channel from the same UE, BS demodulation algorithm should be same regardless multiple TBs are transmitted with interleaved or not.Sub topic 1-2: We prefer option 1. Same comment as PUSCH. From the demodulation we don’t see any difference between the multi-TB allocation and the Rel-13 single TB allocation. Since UE continuously receives the channel from the same BS, UE demodulation algorithm should be same regardless multiple TBs are transmitted with interleaved or not.Sub topic 1-3: We prefer option 1. No new demodulation requirements are needed for MPDCCH/PDSCH using the LTE control region. |
| Nokia | Sub topic 1-1: We prefer option 1. The major gain originates from increased time diversity of the channel. A gain of around 1 dB for the maximum number of 8 TBs and 16 or 32 repetitions is identified in R4-2001479, while for other configurations with smaller number of TBs, the gain is expected to proportionally decrease. Thus, new PUSCH demodulation requirements are not justified.Sub topic 1-2: As for PUSCH, we prefer option 1 (based on the same reasoning). New PDSCH demodulation requirements are not justified.Sub topic 1-3: We can agree with the recommended WF. |

### CRs/TPs comments collection

Not applicable

## 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.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | **Demodulation requirements of PUSCH with multi-TB scheduling**Summary of 1st round: No consensus in the 1st round. Companies supporting defining new PUSCH demodulation requirements with multi-TB scheduling want to verify the time diversity gain according to the interleaved TBs. Companies not supporting new requirements argue it is no receiver impact and also the time diversity gain is not significant with fewer number of TBs. Candidate options:* Option 1: No new PUSCH demodulation requirements with multi-TB scheduling
* Option 2: Define new PUSCH demodulation requirements with multi-TB scheduling

Recommendations for 2nd round:* Continue the discussion in the 2nd round
 |
| **Sub-topic#2** | **Demodulation requirements of PDSCH with multi-TB scheduling** Same as sub topic #1.Candidate options:* Option 1: No new PDSCH demodulation requirements with multi-TB scheduling
* Option 2: Define new PDSCH demodulation requirements with multi-TB scheduling

Recommendations for 2nd round:* Continue the discussion in the 2nd round.
 |
| **Sub-topic#3** | **Demodulation requirements of MPDCCH/PDSCH using LTE control region**Agreements: RAN4 does not define new MPDCCH/PDSCH demodulation requirements with the use of LTE control region.  |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | R4-2002426 Way forward on UE/BS demodulation performance for additional MTC enhancements for LTE(Capture both the agreements and simulation assumptions in topics #1 and #2) | Ericsson |

### CRs/TPs

Not applicable

## Discussion on 2nd round

|  |  |
| --- | --- |
| Company | Comments |
| Ericsson | Sub topic 1: In our understanding, RAN1 designed the multi-TB transmission with few modifications as possible to the receiver algorithm regardless of interleaved or not.Moreover, as Nokia pointed in their contribution, R4-2001915, WI objective in RP-192875 indicates only RAN1/RAN2 as the involved WGs. In our understanding RAN4 indication in the core part WI objective concerned both RAN4 core work and RAN4 performance work.

|  |
| --- |
| **Scheduling enhancement:*** Specify scheduling multiple DL/UL transport blocks with single DCI for SC-PTM and unicast [RAN1, RAN2]
 |

We would like to stick to Option 1. Sub topic 2: Option 1 as the same reason as sub-topic #1.[2020-03-04]For Huawei’s comments, we agree the performance part will define the necessary demodulation requirements of functionality enhancements introduced by RAN1/RAN2. But most companies think the multi-TB transmission does not affect to the demodulation. We may expect the performance gain with interleaved multi-TB transmission, but it comes from the time diversity (non-contiguous transmission), not from new receiver algorithm. As Samsung commented, the non-contiguous transmission can be verified with the existing TDD case with multiple number of HARQ processes.We should also point out eMTC demodulation requirement does not need to align with NB-IoT performance part because it is different feature.  |
| Qualcomm | Sub topic 1-2: We share the same view as Ericsson. Multi-TB transmission has no impact on PHY layer behavior of UE. RAN4’s mandate is not to quantify the gain of multi-TB transmission due to timing diversity. This was already done by RAN1 during the WI. In our view, this is no different than sub-topic 1-3 which also delivers additional gain compared to legacy operation but since it does not necessitate a new UE behavior, no new testing is needed. We don’t understand why Huawei’s position is different in sub-topic 1-3 compared to sub topics 1-1 and 1-2. We support option 1.  |
| Huawei, HiSilicon | Sub topic 1, 2:As for the WI objective in RP-192875 mentioned by Ericsson, we agree that only RAN1, RAN2 are involved in specify scheduling enhancement for multi-TB. However, section 4.2 in RP-192875 says that:C:\Users\l00502554\AppData\Roaming\eSpace_Desktop\UserData\l00502554\imagefiles\6A9B059E-0DBF-44FD-B9C0-A150C7898321.pngBased on our understanding, Performance part needs to specify necessary performance requirement or test cases related to the above mentioned enhancements and core requirements, which means if the enhancement, e.g. multi-TB, is necessary for defining requirements, then it should be. To conclude, we would prefer defining new requirements for multi-TB transmission, more reasons can be aligned with the one in NB-IoT. |

## Summary on 2nd round (if applicable)

*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”* |

# Topic #2: Simulation assumption

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| T-doc number | Company | Proposals / Observations |
| R4-2001352 | Ericsson | **Proposal 1:** RAN4 specifies two MPDCCH demodulation requirements with CRS+DMRS:- Distributed transmission mode, CE Mode A, 2 CRS ports, AL16, [Rep16], EPA5- Localized transmission mode, CE Mode B, 2 CRS ports, AL24, [Rep32], ETU1**Proposal 2:** RAN4 specify the CSI-RS based PMI reporting test with periodic PUCCH 1-1 submode 1. **Proposal 3:** For the CSI-RS based PMI reporting test, set metric as the throughput ratio of the follow PMI over the random PMI. FFS for the SNR test point. |
| R4-2001481 | Huawei, HiSilicon | **Proposal1:** Use the simulation assumption listed in table 2-1 as an initial simulation assumption for discussion |
| R4-2001482 | Huawei, HiSilicon | **Proposal1:** Propose to use the parameter configurations in table 2-1 as an initial simulation assumption for discussion |

## Open issues summary

### Sub-topic 2-1: MPDCCH demodulation requirements

**Issue 2-1: Simulation assumption**

* Proposals
	+ Option 1: Proposal by Ericsson

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1(CE Mode A) | Test 2(CE Mode B) |
| OFDM starting symbol (startSymbolLC) | symbols | 2 | 2 |
| Unused RE-s and PRB-s |  | OCNG | OCNG |
| Cell ID |  | 0 | 0 |
| Downlink power allocation |  | dB | -3 | 0 |
|  | dB | -3 | 0 |
| σ | dB | 0 | -3 |
| δ | dB | 3 | 0 |
| at antenna port | dBm/15kHz | -98 | -98 |
| Cyclic prefix |  | Normal | Normal |
| Subframe Configuration |  | Non-MBSFN | Non-MBSFN |
| Precoder Update Granularity | PRB | N/A | See TS36.211 6.8B.5 |
| ms | N/A | See TS36.211 6.8B.5 |
| Beamforming Pre-Coder |  | See TS36.211 6.8B.5 | See TS36.211 6.8B.5 |
| Cell Specific Reference Signal |  | Port 0 and 1 | Port 0 and 1 |
| Number of PRB per MPDCCH Set |  | 4 | 2+4 |
| Transmission type |  | Distributed | Localized |
| Frequency hopping |  | Disabled | Enabled |
| Number of frequency hopping narrowbands |  | N/A | 4 |
| Frequency hopping offset  |  | N/A | 1 |
| Frequency hopping interval | ms | N/A | 16 |
| Value of G in MPDCCH start subframe (*mpdcch-startSF-UESS*) (Note 3) |  | 1.5 | 1.5 |
| Maximum number of repetitions (*mPDCCH-NumRepetition*) |  | [16] | [32] |
| MPDCCH repetition number |  | [16] | [32] |
| MPDCCH narrowband (*mpdcch-Narrowband*) |  | 1 | 7 |
| PDSCH TM |  | TM2 | TM2 |
| DCI Format |  | 6-1A | 6-1B |
| fdd-DownlinkOrTddSubframeBitmapBR |  | 1111111111 | 1111111111 |
| mpdcch-crs-config |  | Configured | Configured |
| Power offset between CRS and DMRS antenna ports of MPDCCH | dB | 0 | 0 |
| mpdcch-crs-localized-mapping-type |  | N/A | Not configured (cyclic precoder) |
| Note1: For each test, DC subcarrier puncturing shall be considered.Note2: Same precoding matrix is used for a PRB across subframes during the frequency hopping interval.Note 3: For MPDCCH UE-specific search space the formula for the start subframe k0 is given in TS 36.213 [6] clause 9.1.5.Note 4: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate. |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel (TS 36.101) | Propagation condition | Antenna configuration | Pm-dsg (%) |
| 1 | 10MHz | 16 ECCE | R.82 FDD | EPA5 | 2x1 low | 1 |
| 2 | 10MHz | 24 ECCE | R.83 FDD | ETU1 | 2x1 low | 1 |

* + Option 2: Proposal by Huawei, HiSilicon

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | CE Mode A (Test 1) | CE Mode B (Test 1) |
| OFDM starting symbol (startSymbolLC) | symbols | 2 | 2 |
| Unused RE-s and PRB-s |  | OCNG | OCNG |
| Cell ID |  | 0 | 0 |
| Downlink power allocation |  | dB | -3 | 0 |
|  | dB | -3 | 0 |
| σ | dB | 0 | -3 |
| δ | dB | 3 | 0 |
| at antenna port | dBm/15kHz | -98 | -98 |
| Cyclic prefix |  | Normal | Normal |
| Subframe Configuration |  | Non-MBSFN | Non-MBSFN |
| Cell Specific Reference Signal |  | Port 0 and 1 | Port 0 and 1 |
| Number of PRB per MPDCCH Set |  | 4 | 2+4 |
| Transmission type |  | Distributed | Localized |
| Frequency hopping |  | Disabled | Enabled |
| Number of frequency hopping narrowbands |  | N/A | 4 |
| Frequency hopping offset  |  | N/A | 1 |
| Frequency hopping interval | ms | N/A | 16 |
| Value of G in MPDCCH start subframe (*mpdcch-startSF-UESS*) (Note 3) |  | 1.5 | 1.5 |
| Maximum number of repetitions (*mPDCCH-NumRepetition*) |  | 32 | 64 |
| MPDCCH repetition number |  | 32 | 64 |
| MPDCCH narrowband (*mpdcch-Narrowband*) |  | 1 | 7 |
| PDSCH TM |  | TM2 | TM2 |
| DCI Format |  | 6-1A | 6-1B |
| fdd-DownlinkOrTddSubframeBitmapBR |  | 1111111111 | 1111111111 |
| CRS  |  | Enable | Enable |
| Rank |  | 1 | 1 |
| Mapping between CRS and DMRS |  | Predefined | Predefined/Based on CSI report |
| Precoder cycling granularity | PRB | 1 | 1 |
| Precoder cycling pattern  |  | 2Tx: { (0,1), (0,1) }4Tx: {12,13,14,15} | 2Tx: { (0,1), (0,1) }4Tx: {12,13,14,15} |
| Note1: For each test, DC subcarrier puncturing shall be considered.Note2: Same precoding matrix is used for a PRB across subframes during the frequency hopping interval.Note 3: For MPDCCH UE-specific search space the formula for the start subframe k0 is given in TS 36.213 [6] clause 9.1.5.Note 4: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate. |

* Recommended WF
	+ Need more discussion based on the consolidated simulation assumption below

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1(CE Mode A) | Test 2(CE Mode B) |
| OFDM starting symbol (startSymbolLC) | symbols | 2 | 2 |
| Unused RE-s and PRB-s |  | OCNG | OCNG |
| Cell ID |  | 0 | 0 |
| Downlink power allocation |  | dB | -3 | 0 |
|  | dB | -3 | 0 |
| σ | dB | 0 | -3 |
| δ | dB | 3 | 0 |
| at antenna port | dBm/15kHz | -98 | -98 |
| Cyclic prefix |  | Normal | Normal |
| Subframe Configuration |  | Non-MBSFN | Non-MBSFN |
| Precoder Update Granularity | PRB | N/A | See TS36.211 6.8B.5 |
| ms | N/A | See TS36.211 6.8B.5 |
| Beamforming Pre-Coder |  | See TS36.211 6.8B.5 | See TS36.211 6.8B.5 |
| Cell Specific Reference Signal |  | Port 0 and 1 | Port 0 and 1 |
| Number of PRB per MPDCCH Set |  | 4 | 2+4 |
| Transmission type |  | Distributed | Localized |
| Frequency hopping |  | Disabled | Enabled |
| Number of frequency hopping narrowbands |  | N/A | 4 |
| Frequency hopping offset  |  | N/A | 1 |
| Frequency hopping interval | ms | N/A | 16 |
| Value of G in MPDCCH start subframe (*mpdcch-startSF-UESS*) (Note 3) |  | 1.5 | 1.5 |
| Maximum number of repetitions (*mPDCCH-NumRepetition*) |  | Option 1: 16Option 2: 32 | Option 1: 32Option 2: 64 |
| MPDCCH repetition number |  | Option 1: 32Option 2: 64 | Option 1: 32Option 2: 64 |
| MPDCCH narrowband (*mpdcch-Narrowband*) |  | 1 | 7 |
| PDSCH TM |  | TM2 | TM2 |
| DCI Format |  | 6-1A | 6-1B |
| fdd-DownlinkOrTddSubframeBitmapBR |  | 1111111111 | 1111111111 |
| mpdcch-crs-config |  | Configured | Configured |
| Power offset between CRS and DMRS antenna ports of MPDCCH | dB | 0 | 0 |
| mpdcch-crs-localized-mapping-type |  | N/A | Option 1: Not configured (predefined cyclic precoder)Option 2: CSI-based |
| Note1: For each test, DC subcarrier puncturing shall be considered.Note2: Same precoding matrix is used for a PRB across subframes during the frequency hopping interval.Note 3: For MPDCCH UE-specific search space the formula for the start subframe k0 is given in TS 36.213 [6] clause 9.1.5.Note 4: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate. |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel (TS 36.101) | Propagation condition | Antenna configuration | Pm-dsg (%) |
| 1 | 10MHz | 16 ECCE | R.82 FDD | EPA5 | 2x1 low | 1 |
| 2 | 10MHz | 24 ECCE | R.83 FDD | ETU1 | 2x1 low | 1 |

### Sub-topic 2-2: CSI-RS based CSI reporting test

**Issue 2-2: Simulation assumption**

* Proposals
	+ Option 1: Proposal by Ericsson

|  |  |  |
| --- | --- | --- |
| Parameters | Unit | Values |
| Bandwidth | MHz | 10 |
| PDSCH transmission mode |  | 9 |
| Propagation channel |  | EPA5 |
| Precoding granularity | PRB | 6 |
| Downlink power allocation | ρA | dB | 0 |
| ρB | dB | 0 |
| σ | dB | -3 |
| δ | dB | 0 |
| CRS reference signals |  | Antenna ports 0, 1 |
| CSI reference signals |  | Antenna ports 15,…,22 |
| CSI-RS periodicity and subframe offset*T*CSI-RS / *∆*CSI-RS |  | 5/1 |
| CSI reference signal configuration |  | 0 |
| Propagation condition and antenna configuration |  | High XP 8 x 2 |
| Beamforming Model |  | As specified in TS36.101 B.4.3 |
| CodeBookSubsetRestriction bitmap |  | TBD |
| SNR | dB | TBD |
|  | dB[mW/15kHz] | TBD |
|  | dB[mW/15kHz] | -98 |
| Max number of HARQ transmissions |  | 4 |
| Redundancy version coding sequence |  | {0,1,2,3} |
| Reporting mode |  | PUCCH 1-1 submode1 |
| Physical channel for CQI/PMI reporting |  | PUSCH |
| PUCCH Report Type for CQI/second PMI |  | 2b |
| Reporting periodicity  | ms | 10 |
| PMI delay | ms | 10 |
| *cqi-pmi-ConfigurationIndex* |  | 12 |
| ce-csi-rs-feedback-config |  | Configured |
| Frequency hopping |  | Disabled |
| Frequency hopping inverval(interval-FDD) |  | N/A |
| Starting OFDM symbol (startSymbolBR) |  | 3 |
| PDSCH repetition level |  | 1 |
| MPDCCH repetition level |  | 1 |
| Beamforming Precoder for MPDCCH  |  | No precoding |
| Precoder update granularity for MPDCCH |  | N/A |
| BL/CE DL subframe comfiguration (fdd-DownlinkOrTddSubframeBitmapBR) |  | 1111111111 |
| PDSCH PRB size | PRB | 3 |
| PDSCH MCS |  | [QPSK 1/2] |

* + Option 2: Proposal by Huawei, HiSilicon

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
| Bandwidth | MHz | 10 |
| Transmission Scheme |  | TM9 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| σ | dB | 0 |
| δ | dB | 0 |
| Propagation condition  |  | AWGN  |
| Antenna configuration |  | 4 Tx, Cross-polarization: +/-45 degrees2 Rx with X-polarized: 0/+90 degrees |
|  |  dB[mW/15kHz] | -93 | -92 |
|  | dB[mW/15kHz] | -98 | -98 |
| Max number of HARQ transmissions |  | 1 |
| Reporting periodicity  | ms | *Npd* = 10 |
| CQI delay | ms | 10 |
| *cqi-pmi-ConfigurationIndex* |  | 12 |
| Frequency hopping |  | Disabled |
| Frequency hopping inverval(interval-FDD) |  | N/A |
| Starting OFDM symbol (startSymbolBR) |  | 3 |
| PDSCH repetition level |  | 1 |
| MPDCCH repetition level |  | 1 |
| Beamforming Precoder for MPDCCH  |  | No precoding |
| Precoder update granularity for MPDCCH |  | N/A |
| CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) | 8 |
| RI | 1 |
| Report mode | 1-1 |
| Physical channel for CSI report |  | PUCCH/PUSCH |
| Note 1: Table 7.2.4-1 of TS 36.213 is reused for the support of CSI-RS based CSI feedback for non-BL UEs in CE mode A.Note 2: Assuming RI=1, Table 7.2.2-1E in TS 36.213 is reused without modification for the support of CSI-RS based CSI feedback for non-BL UEs in CE mode A.Note 3: Assuming RI=1, Table 7.2.2-1D in TS 36.213 is reused without modification for the support of CSI-RS based CSI feedback for non-BL UEs in CE mode A. |

* Recommended WF
	+ Test metric for CSI-RS based CSI reporting test
		- Option 1: Throughput ratio of the follow PMI over the random PMI
	+ Transmission mode
		- Option 1: PUCCH 1-1 submode 1
	+ Propagation condition
		- Option 1: EPA5
		- Option 2: AWGN
	+ Antenna configuration
		- Option 1: High XP 8 x 2
		- Option 2: 4 Tx, Cross-polarization: +/-45 degrees, 2 Rx with X-polarized: 0/+90 degrees

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| Company | Comments |
| Qualcomm | Sub topic 2-1: We support option 1.Sub topic 2-2: We support option 1.  |
| Huawei, HiSilicon | Sub topic 2-1: For mapping type between CRS and DMRS, predefined mapping and mapping based on CSI report are all supported based on the RAN1 agreements. Other companies’ views are encouraged on choosing one of them. Either predefined and CSI report based mapping type is fine for us.Sub topic 2-2: For the test metric and the transmission mode, we support option 1 for both of them. We also prefer to list the details of CSI-RS configurations like number of CSI-RS ports and CSI-RS resource type etc. |
| Ericsson | Sub topic 2-1: For mpdcch-crs-localized-mapping-type, we prefer option 1, since it is MPDCCH demodulation requirements, the test should verifiy the demodulation based on CRS+DMRS. Another reason is it is for CE Mode B test, which means the SNR test point is very low. We think the estimated PMI is noisy and not good for codebook selection. For MPDCCH repetition level, we are ok to keep both options in this meeting and decide according to the simulation results. Sub topic 2-2:Metric: RAN1 introduced CSI-RS based feedback for TM9 with PUCCH 1-1 submode 1 and 2, which means we should verify PMI feedback. Therefore we propose the metric should be the throughput ratio of the follow PMI over the random PMI.Transmission mode: We prefer to use PUCCH 1-1 submode 1 rather than submode 2 since the most existing CSI reporting tests in TS36.101 uses submode.Propagation: Since it is PMI reporting test, we prefer to use EPA5 instead of AWGN.Antenna configuration: RAN1 agreement is CSI-RS based feedback for non-BL UE is applicable only if the UE is configured with PMI/RI reporting and number of CSI-RS ports=8. This means the number of CRS-RS ports should be 8. So we prefer to set 8x2 XPOL HIGH. |
| Nokia | Sub topic 2-1: For localized transmission in CE mode B, requirements should be defined for both modes precoder cycling and CSI-based (option 1 and option 2 in the recommended WF above) as contained in our Proposal 3 in R4-2001915.Sub topic 2-2: Both proposals (option 1 and option 2) should be further justified and discussed in the next meeting. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

Note applicable

## 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.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | **Simulation assumption of MPDCCH demodulation using CRS and DMRS**Tentative agreements:* Simulation parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1(CE Mode A) | Test 2(CE Mode B) |
| OFDM starting symbol (startSymbolLC) | symbols | 2 | 2 |
| Unused RE-s and PRB-s |  | OCNG | OCNG |
| Cell ID |  | 0 | 0 |
| Downlink power allocation |  | dB | -3 | 0 |
|  | dB | -3 | 0 |
| σ | dB | 0 | -3 |
| δ | dB | 3 | 0 |
| at antenna port | dBm/15kHz | -98 | -98 |
| Cyclic prefix |  | Normal | Normal |
| Subframe Configuration |  | Non-MBSFN | Non-MBSFN |
| Precoder Update Granularity | PRB | N/A | See TS36.211 6.8B.5 |
| ms | N/A | See TS36.211 6.8B.5 |
| Beamforming Pre-Coder |  | See TS36.211 6.8B.5 | See TS36.211 6.8B.5 |
| Cell Specific Reference Signal |  | Port 0 and 1 | Port 0 and 1 |
| Number of PRB per MPDCCH Set |  | 4 | 2+4 |
| Transmission type |  | Distributed | Localized |
| Frequency hopping |  | Disabled | Enabled |
| Number of frequency hopping narrowbands |  | N/A | 4 |
| Frequency hopping offset  |  | N/A | 1 |
| Frequency hopping interval | ms | N/A | 16 |
| Value of G in MPDCCH start subframe (*mpdcch-startSF-UESS*) (Note 3) |  | 1.5 | 1.5 |
| Maximum number of repetitions (*mPDCCH-NumRepetition*) |  | Option 1: 16Option 2: 32 | Option 1: 32Option 2: 64 |
| MPDCCH repetition number |  | Option 1: 16Option 2: 32 | Option 1: 32Option 2: 64 |
| MPDCCH narrowband (*mpdcch-Narrowband*) |  | 1 | 7 |
| PDSCH TM |  | TM2 | TM2 |
| DCI Format |  | 6-1A | 6-1B |
| fdd-DownlinkOrTddSubframeBitmapBR |  | 1111111111 | 1111111111 |
| mpdcch-crs-config |  | Configured | Configured |
| Power offset between CRS and DMRS antenna ports of MPDCCH | dB | 0 | 0 |
| mpdcch-crs-localized-mapping-type |  | N/A | Option 1: Not configured (predefined cyclic precoder)Option 2: CSI-based |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel (TS 36.101) | Propagation condition | Antenna configuration | Pm-dsg (%) |
| 1 | 10MHz | 16 ECCE | R.82 FDD | EPA5 | 2x1 low | 1 |
| 2 | 10MHz | 24 ECCE | R.83 FDD | ETU1 | 2x1 low | 1 |

* For the maximum number of repetitions (*mPDCCH-NumRepetition*), the moderator recommends keeping two options. Interested companies are encouraged to provide the simulation results in the next meeting and decide the repetition level considering the achieved SNR levels.
	+ Note the required SNR of CE Mode A result should be larger than [-6]dB.
	+ Note the required SNR of CE Mode B results should larger than [-15]dB.

For mpdcch-crs-localized-mapping-type, one company wants to set both ‘predefined cyclic precoder’ and ‘CSI-based’ precoder. Other companies support to set ‘predefined cyclic precoder’ only. Candidate options for mpdcch-crs-localized-mapping-type in Test 2 (CE Mode B) as follows:* Option 1: Test with ‘predefined cyclic precoder’ only
* Option 2: Test both ’predefined cyclic precoder’ and ‘CSI-based’ precoder

Recommendations for 2nd round:* Discuss the options for mpdcch-crs-localized-mapping-type in Test 2 (CE Mode B)
* According to the 2nd round outcome, the moderator wants to capture the agreed simulation assumption in the way forward.
 |
| **Sub-topic#2** | **Simulation assumption of CSI-RS based CSI reporting test**Tentative agreements:* Simulation parameters

|  |  |  |
| --- | --- | --- |
| Parameters | Unit | Values |
| Bandwidth | MHz | 10 |
| PDSCH transmission mode |  | 9 |
| Propagation channel |  | [EPA5] |
| Precoding granularity | PRB | 6 |
| Downlink power allocation | ρA | dB | 0 |
| ρB | dB | 0 |
| σ | dB | -3 |
| δ | dB | 0 |
| CRS reference signals |  | Antenna ports 0, 1 |
| CSI reference signals |  | Antenna ports 15,…,22 |
| CSI-RS periodicity and subframe offset*T*CSI-RS / *∆*CSI-RS |  | 5/1 |
| CSI reference signal configuration |  | 0 |
| Propagation condition and antenna configuration |  | [High XP 8 x 2] |
| Beamforming Model |  | As specified in TS36.101 B.4.3 |
| CodeBookSubsetRestriction bitmap |  | TBD |
| SNR | dB | TBD |
|  | dB[mW/15kHz] | TBD |
|  | dB[mW/15kHz] | -98 |
| Max number of HARQ transmissions |  | 4 |
| Redundancy version coding sequence |  | {0,1,2,3} |
| Reporting mode |  | [PUCCH 1-1 submode1] |
| Physical channel for CQI/PMI reporting |  | PUSCH |
| PUCCH Report Type for CQI/second PMI |  | 2b |
| Reporting periodicity  | ms | 10 |
| PMI delay | ms | 10 |
| *cqi-pmi-ConfigurationIndex* |  | 12 |
| ce-csi-rs-feedback-config |  | Configured |
| Frequency hopping |  | Disabled |
| Frequency hopping inverval(interval-FDD) |  | N/A |
| Starting OFDM symbol (startSymbolBR) |  | 3 |
| PDSCH repetition level |  | 1 |
| MPDCCH repetition level |  | 1 |
| Beamforming Precoder for MPDCCH  |  | No precoding |
| Precoder update granularity for MPDCCH |  | N/A |
| BL/CE DL subframe comfiguration (fdd-DownlinkOrTddSubframeBitmapBR) |  | 1111111111 |
| PDSCH PRB size | PRB | 3 |
| PDSCH MCS |  | [QPSK 1/2] |
| RI |  | 1 |

* Test metric: Throughput ratio of the follow PMI over the random PMI

Recommendations for 2nd round: * Encourage companies to review the parameters and metric.
* According to the 2nd round outcome, the moderator wants to capture the agreed simulation assumption in the way forward.
 |

*Suggestion on WF/LS assignment*

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

### CRs/TPs

Note applicable

## Discussion on 2nd round

|  |  |
| --- | --- |
| Company | Comments |
| Ericsson | Sub topic 1: For mpdcch-crs-localized-mapping-type, we prefer Option 1. We understand RAN1 specification supports precoder with predefined cycling and CSI feedback. If we look the simulation assumption above, the localized transmission is set for CE Mode B. Since CE Mode B test targets SNR < -10dB, we don’t believe UE can estimate the right PMI in such low SNR points. Another reason is RAN4 UE demodulation requirements usually avoid the feedback from UE so that the test focuses on the UE demodulation receiver performance. With these reasons, we propose to assume Option 1 (predefined cyclic prefix).Sub topic 2: Fine with the recommend simulation assumption. |
| Qualcomm | Sub topic 2-1: We also support option 1 for mpdcch-crs-localized-mapping-type. CSI feedback in CE mode B is not even supported in FDD. Also, with TM2, UE cannot report PMI so if PMI-feedback needs to be tested, TM6 or TM9 should be configured which is not preferred.  |
| Huawei, HiSilicon | Sub topic 2-1:We are fine with option 1 for mpdcch-crs-localized-mapping-type.  |

## Summary on 2nd round (if applicable)

*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”* |