**3GPP TSG-RAN4 Meeting # 95-e *R4-2008749***

**E-meeting, 25th May 2020 - 5th June 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-4** | **CR** | **0043** | **rev** | **1** | **Current version:** | **15.5.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | CR to TS 38.101-4: Beamforming clarification (R15) |
|  |  |
| ***Source to WG:*** | Intel Corporation |
| ***Source to TSG:*** | RAN4 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Perf |  | ***Date:*** | 2020-05-15 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-15 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Details of beamforming for different DL channels are not defined |
|  |  |
| ***Summary of change:*** | 1. Added references to beamforming model in section B.4.1 for FR1 and FR2 PDCCH requirements
2. Updated precoder configuration for FR2 PDCCH requirements to align with FR1 wording
3. Added reference on TS 38.214 in section with beamforming model
4. Added details of PDCCH, PBCH, SSS, PSS mapping to physical antenna elements
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|  |  |
| ***Consequences if not approved:*** | Details of beamforming for different DL channels will be misssing |
|  |  |
| ***Clauses affected:*** | 5.3, 7.3, B.4.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  |  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-4 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**START OF CHANGE**

## 5.3 PDCCH demodulation requirements

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

The parameters specified in Table 5.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 5.3-1: Common test Parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) |  | 0 |
| DL BWP configuration #1 | Cyclic prefix |  | Normal |
| RB offset | RBs | 0 |
| Common serving cell parameters | Physical Cell ID |  | 0 |
| SSB position in burst |  | 1 |
| SSB periodicity | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) |  | CSI-RS resource 1: 4CSI-RS resource 2: 8CSI-RS resource 3: 4CSI-RS resource 4: 8 |
| Number of CSI-RS ports (*X*) |  | 1 |
| CDM Type |  | No CDM |
| Density (*ρ*) |  | 3 |
| CSI-RS periodicity | Slots | 15 kHz SCS: 2030 kHz SCS: 40 |
| CSI-RS offset | Slots | 15 kHz SCS:10 for CSI-RS resource 1 and 211 for CSI-RS resource 3 and 430 kHz SCS:20 for CSI-RS resource 1 and 221 for CSI-RS resource 3 and 4 |
| Frequency Occupation |  | Start PRB 0Number of PRB = BWP size |
| QCL info |  | TCI state #0 |
| TCI state #0 | Type 1 QCL information  | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information  | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| PDCCH & PDCCH DMRS Precoding configuration |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination with REG bundling granularity for number of Tx larger than 1 |
| Physical signals, channels mapping and precoding |  | As specified in Annex B.4.1 |
| Symbols for all unused REs |  | OCNG in Annex A.5 |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing. |

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## 7.3 PDCCH demodulation requirements

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

The parameters specified in Table 7.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 7.3-1: Common test Parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) |  | 0 |
| DL BWP configuration #1 | Cyclic prefix |  | Normal |
| Common serving cell parameters | Physical Cell ID |  | 0 |
| SSB position in burst |  | 1 |
| SSB periodicity | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (k0) |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | CSI-RS resource 1: 4CSI-RS resource 2: 8CSI-RS resource 3: 4CSI-RS resource 4: 8 |
| Number of CSI-RS ports (X) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 3 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 80 for CSI-RS resource 1 and 281 for CSI-RS resource 3 and 4 |
| Frequency Occupation |  | Start PRB 0Number of PRB = BWP size |
| QCL info |  | TCI state #0 |
| NZP CSI-RS for beam management | First subcarrier index in the PRB used for CSI-RS (k0) |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | CSI-RS resource 1: 8CSI-RS resource 2: 9 |
| Number of CSI-RS ports (X) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 3 |
| CSI-RS periodicity | Slots | 120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | Slots | 0 for CSI-RS resource 1,2 |
| Repetition |  | ON |
| QCL info |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration |  | Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| Physical signals, channels mapping and precoding |  | As specified in Annex B.4.1 |
| Symbols for all unused REs |  | OCNG in Annex A.5 |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing. |

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# B.4 Physical signals, channels mapping and precoding

## B.4.1 General

Unless otherwise stated, the transmission on antenna port(s) is defined by using a precoder matrix  of size , where is the number of physical transmit antenna elements configured per test , is the number of ports for a reference signal or physical channel configured per test, and is the first port for that reference signal or physical channel as defined in clauses 7.3 and 7.4 in TS 38.211 [9]. This precoder takes as an input a block of signals for antenna port(s) , , , with  being the number of modulation symbols per antenna port including the reference signal symbols, and generates a block of signals the elements of which are to be mapped onto the frequency-time index pair as per the test configuration but transmitted on different physical antenna elements:

For Clause 6 and 8, the transmission of PDCCH and PDCCH DMRS on antenna port is defined by using a precoder matrix  of size 2x1. This precoder takes as an input a block of signals for antenna port(s) , and generates a block of signals the elements of which are to be mapped onto the frequency-time index pair as per the test configuration but transmitted on different physical antenna elements:

The precoder matrix is specific to the test case configuration.  is defined in Clause 5.2.2.2 of TS 38.214 [12].

The transimison on PT-RS antenna port is associated (using same precoder) with the lowest indexed DM-RS antenna port among the DM-RS antenna ports assigned for the PDSCH.

The physical antenna elements are identified by indices, where  is the number of physical antenna elements configured per test.

Modulation symbols with (i.e. PSS, SSS, PBCH and DM-RS for PBCH) are directly mapped to first physical antenna element.

Modulation symbols  for CSI-RS resources which configured for tracking with one port are directly mapped to first physical antenna element.

Modulation symbols  for CSI-RS resources which configured for beam refinement with one port are directly mapped to first physical antenna element.

Modulation symbols  for NZP CSI-RS which configured for CSI acquisition with  are mapped to the physical antenna index  where is the number of NZP CSI-RS ports configured per test.

**END OF CHANGE**