**3GPP TSG-RAN WG4 Meeting #111 R4-2410359 Fukuoka City, Japan, 20th – 24th May, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **-** | **rev** | **-** | **Current version:** | **18.5.0** |  |
|  | | | | | | | | |
| *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:*** | for multi-Rx | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | OPPO, Xiaomi | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_FR2\_multiRX\_DL-Perf | | | | |  | ***Date:*** | | | 2024-5-7 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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 can be 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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The RRM requirements of RP specific CSI-RS based BFD requirements under multi-Rx in R18 needs to be verified. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce the test case for verifying TRP specific CSI-RS based BFD measurement delay for R18 multi-Rx. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The test case for TRP specific CSI-RS based BFD requirements under multi-Rx is missing. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | (new) A.7.5.5.x | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

Start of Change 1

#### A.7.5.5.X TRP specific Beam Failure Detection and Link Recovery for FR2 PCell configured with CSI-RS-based BFD and LR and multi-Rx operation in DRX mode

##### A.7.5.5.X.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects TRP specific CSI-RS-based beam failure and link recovery in the sets and for TRP0 and sets and for TRP1 when DRX is used for an FR2 PCell requirements in clause 8.18.

The test parameters are given in Tables A.7.5.5.X.1-1, A.7.5.5.X.1-2 and A.7.5.5.X.1-3. Cell 1 is the active PCell in the test. PCell is configured with two TRPs. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.X.1-3 shows the variation of the downlink SNR of the CSI-RS in set and in the PCell for TRP0 and TRP1 respectively. Figure A.7.5.5.X.1-3 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in for TPR0. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms.

In the test, UE is capable of multi-Rx operation and configured with group-based beam reporting (GBBR) on the cell 1. During T1, UE shall be able to report via beam pair assoiated with sets for TRP0 and for TRP1. After T5, UE shall be able to report via new beam pair associated with sets for TRP0 and for TRP1.

During T2 and T3, for beam failure detection, CSI-RS resources in the two sets for TRP0 and for TRP1 are overlapped on the same OFDM symbol according to CSI-RS configuration in table A.7.5.5.X.1-2 and A.3.14.2-3, and the conditions in clause 8.18.3.2 are met.

During T4 and T5, for candidate beam detection, CSI-RS resources in the two sets for TRP0 and for TRP1 are also overlapped according to CSI-RS configuration in table A.7.5.5.X.1-2 and and A.3.14.2-3.

In addition, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.X.1-1: Supported test configurations for FR2 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |

Table A.7.5.5.X.1-2: General test parameters for FR2 PCell for beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value | Comment |
|  | | |  | Test 1 |  |
| Active PCell | | |  | Cell 1 |  |
| RF Channel Number for PCell | | |  | 1 |  |
| Duplex mode | | Config 1 |  | TDD |  |
| BW channel | | Config 1 |  | 100: NRB,c = 66 |  |
| DL initial BWP configuration | | Config 1 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | Config 1 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | Config 1 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | Config 1 |  | ULBWP.1.1 |  |
| TDD Configuration | | Config 1 |  | TDDConf.3.1 |  |
| CORESET Reference Channel | | Config 1 |  | CR.3.1 TDD | A.3.1.2 |
| SSB Configuration | | Config 1 |  | SSB.3 FR2 | A.3.11 |
| SMTC Configuration | | Config 1 |  | SMTC.3 | A.3.10 |
| PDSCH/PDCCH subcarrier spacing | | Config 1 |  | 120 KHz |  |
| PRACH Configuration | | Config 1 |  | Table A.3.8.3.1-1 |  |
| CSI-RS configuration for TRP0 | | Config 1 |  | CSI-RS.3.2 TDD | A.3.14.2 |
| CSI-RS configuration for TRP1 | | Config 1 |  | CSI-RS.3.6 TDD | A.3.14.2 |
| CSI-RS configuration for CSI reporting | | Config 1 |  | CSI-RS.3.1 TDD | A.3.14.2 |
| TRS configuration | | Config 1 |  | TRS.2.1 TDD |  |
| TCI configuration | | Config 1 |  | CSI-RS.Config.0 |  |
| OCNG parameters | |  |  | OP.1 |  |
| CP length | |  |  | Normal |  |
| Correlation Matrix and Antenna Configuration | |  |  | 2x2 Low |  |
| OCNG parameters | | |  | OP.1 | A.3.2.1 |
| CP length | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | |  | 2x2 Low |  |
| Beam failure | | DCI format |  | 1-0 |  |
| detection transmission parameters | | Number of Control OFDM symbols |  | 2 |  |
|  | | Aggregation level | CCE | 8 |  |
|  | | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 |  |
|  | | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 |  |
|  | | DMRS precoder granularity |  | REG bundle size |  |
|  | | REG bundle size |  | 6 |  |
| DRX | | |  | DRX.3 |  |
| Gap pattern ID | | |  | N.A. |  |
| schedulingRequestID-BFR-SCell-r16 | | |  | Configured |  |
| Periodicity of PUCCH for SR configuration for BFR on SCell | | | Slot | 40 | 5ms |
| Offset of PUCCH for SR configuration for BFR on SCell | | | Slot | 5 |  |
| PUCCH parameters for SR configuration for BFR on SCell | | |  | Table 8.3.3.1.2-1 in [13] |  |
| CSI-RS Index assigned as BFD RS in set (q0,0) | | |  | 0 |  |
| CSI-RS Index assigned as CBD RS in set (q1,0) | | |  | 1 |  |
| CSI-RS Index assigned as BFD RS in set (q0,1) | | |  | 2 |  |
| CSI-RS Index assigned as CBD RS in set (q1,1) | | |  | 3 |  |
| CSI-RS index assigned as RLM RS | | |  | 0, 1 |  |
| SSB index assigned as RLM RS | | |  | 0, 1 |  |
| rlmInSyncOutOfSyncThreshold | | |  | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdCSI-RS | Config 1 | | dBm/SCS | -95 | Threshold used for Qin\_LR\_CSI-RS |
| powerControlOffsetSS | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | |  | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | |  | pbfd4 | see TS 38.321 [7], clause 5.17 |
| T310 Timer | | | ms | 1000 |  |
| N310 | | |  | 2 |  |
| T1 | | | s | [1] | During this time the the UE shall be fully synchronized to cell 1 |
| T2 (BFD time +CBD time +margin) | | | s | [5.69] |  |
| T3 (BFD time +margin) | | | s | [5.16] |  |
| T4 | | | s | 0 |  |
| T5 (CBD time +margin) | | | s | 0.57 |  |
| D1 (CBD time +margin) | | | s | 0.53 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

Table A.7.5.5.X.1-3: Cell specific test parameters for FR2 PCell for beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell1 | | | | | |
|  | T1 | T2 | T3 | | T4 | T5 |
| AoA setup |  | [Setup X2] as specified in clause A.3.15 Note 11 | | | | | |
| Assumption for UE beams Note 10 |  | Rough | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | dB | 0 | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | dB |
| EPRE ratio of PBCH DMRS to SSS | dB |
| EPRE ratio of PBCH to PBCH DMRS | dB |
| EPRE ratio of PSS to SSS | dB |
| EPRE ratio of PDSCH DMRS to SSS | dB |
| EPRE ratio of PDSCH to PDSCH DMRS | dB |
| EPRE ratio of OCNG DMRS to SSS | dB |
| EPRE ratio of OCNG to OCNG DMRS | dB |
| SNR\_CSI-RS of set q0,0 | dB | 5 | -3 | -12 | | -12 | -12 |
| SNR\_CSI-RS of set q0,1 | dB | 5 | 5 | 5 | | 5 | 5 |
| SNR\_CSI-RS of set q1,0 | dB | 0.2 | 0.2 | 20.2 | | 20.2 | 20.2 |
| CSI-RS\_RP of set q1,0 | dBm/  SCS kHz | -104.5 | -104.5 | -84.5 | | -84.5 | -84.5 |
| Noc | dBm/120 kHz | -104.7 | | | | | |
| Propagation condition |  | TDL-A 30ns 75Hz | | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 4: Void  Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.  Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.  Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.7.1-1.  Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.  Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.  Note 11: [AoA1 and AoA3 are for TRP0 of PCell, AoA2 is for TRP1 of PCell]. AoA1 and A0A2 are from the set of [qualified AoA pairs] | | | | | | | |



Figure A.7.5.5.X.1-1: SNR and L1-RSRP variation for beam failure detection and link recovery testing for PCell in DRX mode

##### A.7.5.5.X.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 in A.7.5.5.X.1 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 with sets for TRP0 and sets for TRP1. During T1, UE reports via beam pair assoiated with sets for TRP0 and for TRP1.

During the period from time point A to time point B the UE shall transmit uplink signal in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3, T4, T5, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 with sets for TRP1.

During T3 the UE shall detect beam failure and initiate link recovery for TRP0. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate sets for TRP0 and for TRP1.

No later than time point F occurring no later than D1 after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing beam associated with the candidate beam with sets for TRP0. The UE shall not transmit PUCCH with an LRR with candidate beam set for TRP0 earlier than time point B.

[After T5, UE shall be able to report via new beam pair associated with sets for TRP0 and for TRP1.]

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

End of Change 1