**3GPP TSG-RAN4 Meeting #104-e *R4-22xxxxx***

**Electronic meeting, Aug 15th – Aug 26th, 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** |  | **rev** | **-** | **Current version:** | **17.6.0** |  |
|  | | | | | | | | |
| *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:*** | Big CR: RRM requirements for Rel-17 NR feMIMO | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Samsung | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_feMIMO-Perf | | | | |  | ***Date:*** | | | 2022-8-30 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | RRM performance requirements for NR feMIMO are introduced into TS 38.133 from draft CRs endorsed in RAN4 #103-e and #104-e meetings. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | RRM requirements for NR feMIMO endorsed in the following draft CRs are added to TS 38.133   1. R4-2208277 Draft CR to TS38.133 Accuracy Requirement for R17 L1-SINR Measurement on NSC (endorsed CR from RAN4#103-e) 2. R4-2214938 DraftCR to TS 38.133TRP specific Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode 3. R4-2214939 DraftCR to TS 38.133 TRP specific Beam Failure Detection and Link Recovery Test for FR2 SCell configured with CSI-RS-based BFD and LR in DRX mode 4. R4-2214965 Draft CR on TC for joint unified TCI state switching in FR2 NR SA 5. R4-2214969 Draft CR on test case for DL TCI state switching for Cell with different PCI in FR2 NR-SA 6. R4-2214970 Draft CR on test case for L1-RSRP measurement procedure in FR1 NR-SA 7. R4-2214980 Draft CR to TS38.133 TRP-specific beam failure recovery on NSC (EN-DC, FR1) 8. R4-2214981 Draft CR to TS38.133 TRP-specific beam failure recovery on NSC (EN-DC FR2) 9. R4-2215030 Draft CR to TS38.133 Test case for R17 UL TCI state switching 10. R4-2215063 DraftCR on introducing unified TCI configuration 11. R4-2215064 DraftCR on L1-RSRP measurement test for R17 inter-cell beam managements 12. R4-2215065 DraftCR on SSB and CSI-RS configurations for TRP specific BFR tests 13. R4-2215097 Draft CR on test case for MAC CE based TCI state switch for a known joint TCI state in FR2 EN-DC in TS38.133 A7.5.Y.1 14. R4-2215099 Draft CR on UL TCI state switching when PL-RS is not maintained for FR2 PCell 15. R4-2215100 Draft CR on CSI-RS-based BFD and SSB-based LR for SCell with Non-DRX in EN-DC scenario 16. Draft CR for test case for FeMIMO - Unified TCI state switching for EN-DC in FR2 17. R4-2215161 Draft CR for test case for FeMIMO – TRP specific BFR for NR-SA in FR1 (PCell) | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No performance requirements for NR FeMIMO in TS 38.133 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 10.1.19, A.3.10, A.3.14, A.3.16A, A.4.5.5, A.5.5, A.6.5, A.6.6.4, A.7.5, A.7.5.8, A.7.6.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS38.533 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | The 1st version | | | | | | | | |

==========================Start of change 1 =============================

# 10 Measurement Performance requirements

## 10.1 NR measurements

### 10.1.19 L1-RSRP accuracy requirements for FR1

10.1.19.1 SSB based L1-RSRP accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy and relative accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement and all SSBs of cell(s) with different PCI from serving cell configured for L1-RSRP measurement in FR1.

10.1.19.1.1 Absolute Accuracy

The accuracy requirements in Table 10.1.19.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.

10.1.19.1.2 Relative Accuracy

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the cell (serving cell or cell with different PCI from serving cell) on which UE performs L1-RSRP measurements.

The accuracy requirements in Table 10.1.19.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.

10.1.20.1 SSB based L1-RSRP accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy and relative accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement and all SSBs of cell(s) with different PCI from serving cell configured for L1-RSRP measurement in FR2.

10.1.20.1.1 Absolute Accuracy

The accuracy requirements in Table 10.1.20.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

10.1.20.1.2 Relative Accuracy

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the cell (serving cell or cell with different PCI from serving cell) on which UE performs L1-RSRP measurements.

The accuracy requirements in Table 10.1.20.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

==========================End of change 1 =============================

==========================Start of change 2 =============================

# A.3 RRM test configurations

## A.3.10 SSB Configurations

### A.3.10.1 SSB Configurations for FR1

A.3.10.1.7 SSB pattern 7 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

**Table A.3.10.1.7-1: SSB.7 FR1: SSB Pattern 7 for SSB SCS=15 kHz in 10 MHz channel**

|  |  |  |
| --- | --- | --- |
| **SSB Parameters** | **Values** | |
| Channel bandwidth | 10 MHz | |
| SSB SCS | 15 kHz | |
| SSB periodicity (TSSB) | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 2 | 3 |
| Symbol numbers containing SSB Note 2 | 2-5 | 8-11 |
| Slot numbers containing SSB Note 2 | 1 | 1 |
| SFN containing SSB | SFN mod (max(TSSB,10ms)/10ms) = 0 | |
| RB numbers containing SSB within channel BW | (RBJ, RBJ+1,.…, RBJ+19)Note 1 | |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104  [13].  Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves. | | |

A.3.10.1.8 SSB pattern 8 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

**Table A.3.10.1.8-1: SSB.8 FR1: SSB Pattern 8 for SSB SCS=30 kHz in 40 MHz channel**

|  |  |  |
| --- | --- | --- |
| **SSB Parameters** | **Values** | |
| Channel bandwidth | 40 MHz | |
| SSB SCS | 30 kHz | |
| SSB periodicity (TSSB) | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 2 | 3 |
| Symbol numbers containing SSB Note 3 | 4-7 or 2-5 Note 2 | 8-11 |
| Slot numbers containing SSB Note 3 | 1 | 1 |
| SFN containing SSB | SFN mod (max(TSSB,10ms)/10ms) = 0 | |
| RB numbers containing SSB within channel BW | (RBJ, RBJ+1,.…, RBJ+19)Note 1 | |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].  Note 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by Table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen.  Note 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves. | | |

A.3.10.2 SSB Configurations for FR2

A.3.10.2.9 SSB pattern 9 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

**Table A.3.10.2.9-1: SSB.9 FR2: SSB Pattern 9 for SSB SCS = 120 kHz in 100 MHz channel with 2 SSBs per SS-burst**

|  |  |  |
| --- | --- | --- |
| **SSB Parameters** | **Values** | |
| Channel bandwidth | 100 MHz | |
| SSB SCS | 120 kHz | |
| SSB periodicity (TSSB) | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 2 | 3 |
| Symbol numbers containing SSBs Note 2 | 2-5 | 6-9 |
| Slot numbers containing SSB Note 2 | 1 | 1 |
| SFN containing SSB | SFN mod (max(TSSB,10ms)/10ms) = 0 | |
| RB numbers containing SSBs within channel BW | (RBJ, RBJ+1,.…, RBJ+19)Note 1 | |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].  Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves. | | |

A.3.10.2.10 SSB pattern 10 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

**Table A.3.10.2.10-1: SSB.10 FR2: SSB Pattern 10 for SSB SCS = 240 kHz in 100 MHz channel with 2 SSBs per SS-burst**

|  |  |  |
| --- | --- | --- |
| **SSB Parameters** | **Values** | |
| Channel bandwidth | 100 MHz | |
| SSB SCS | 240 kHz | |
| SSB periodicity (TSSB) | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 2 | 3 |
| Symbol numbers containing SSBs Note 2 | 4-7 | 8-11 |
| Slot numbers containing SSB Note 2 | 1 | 1 |
| SFN containing SSB | SFN mod (max(TSSB,10ms)/10ms) = 0 | |
| RB numbers containing SSBs within channel BW | (RBJ, RBJ+1,.…, RBJ+39)Note 1 | |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].  Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves. | | |

==========================End of change 2=============================

==========================Start of change 3 =============================

A.3.14 CSI-RS configurations

A.3.14.1 FDD

**Table A.3.14.1-1: CSI-RS Reference Measurement Channels for SCS=15kHz**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CSI-RS.1.1 FDD** | **CSI-RS.1.2 FDD** | **CSI-RS.1.3 FDD** | **CSI-RS.1.4 FDD** | **CSI-RS.1.5 FDD** | **CSI-RS.1.6 FDD** | **CSI-RS.1.7 FDD** |
| **Resource Type** | **periodic** | **periodic** | **aperiodic** | **aperiodic** | **aperiodic** | **periodic** | **periodic** |
| **Resource Set Config** |  |  |  |  |  |  |  |
| nzp-CSI-ResourceSetId | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| repetition | n.a. | off | off | on | off | n.a. | off |
| aperiodicTriggeringOffset | n.a. | n.a. | 4 | 4 | 6 | n.a. | n.a. |
| trs-Info | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |  |  |  |  |
|  |  | 0 for resource #0 | 0 for resource #0 | 0 for resource #0 | 0 for resource #0 |  | 2 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |  |
|  |  |  |  | 2 for resource #2 |  |  |
|  |  |  |  | 3 for resource #3 |  |  |
| nzp-CSI-RS-ResourceId | 0 for resource #0 | 1 for resource #1 | 1 for resource #1 | 4 for resource #4 | 1 for resource #1 | 0 for resource #0 | 3 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |  |
|  |  |  |  | 6 for resource #6 |  |  |
|  |  |  |  | 7 for resource #7 |  |  |
| powerControlOffset | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 | db0 | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Period (slots) | slot5 | slot10 | n.a. | n.a. | n.a. | slot40 | slot10 |
| Offset | 1 | 1 | n.a. | n.a. | n.a. | 1 | 1 |
| qcl-InfoPeriodicCSI-RS | TCI.State.0 | TCI.State.0 | n.a. | n.a. | n.a. | TCI.State.0 | TCI.State.0 |
|  |  | TCI.State.1 |  |  |  |  | TCI.State.1 |
| frequencyDomainAllocation | 000001 | 0001 | 0001 | 0001 | 000001 | 000001 | 0100 |
| nrofPorts | 2 | 1 | 1 | 1 | 1 | 2 | 1 |
|  |  | 6 for resource #0 | 6 for resource #0 | 0 for resource #0 | Specified in the test case for resource #0 |  | 6 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |  |  |
|  |  |  |  | 2 for resource #2 |  |  |  |
|  |  |  |  | 3 for resource #3 |  |  |  |
| firstOFDMSymbolInTimeDomain | 4 for resource #0 | 10 for resource #1 | 10 for resource #1 | 4 for resource #4 | n.a. | 5 for resource #0 | 10 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |  |  |
|  |  |  |  | 6 for resource #6 |  |  |  |
|  |  |  |  | 7 for resource #7 |  |  |  |
| cdm-Type | FD-CDM2 | noCDM | noCDM | noCDM | noCDM | FD-CDM2 | noCDM |
| density | 1 | 3 | 3 | 3 | 3 | 1 | 3 |
| startingRB | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | | | | | |

**Table A.3.14.1-1A: CSI-RS Reference Measurement Channels for SCS=15kHz**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **CSI-RS.1.1A FDD** | **CSI-RS.1.2A FDD** | **CSI-RS.1.3A FDD** |
| Resource Type | periodic | aperiodic | periodic |
| **Resource Set Config** |  |  |  |
| nzp-CSI-ResourceSetId | 1 | 1 | 1 |
| repetition | off | off | off |
| aperiodicTriggeringOffset | n.a. | 6 | n.a. |
| trs-Info | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for resource #0 | 22 for resource #0 | 14 for resource #0 |
|  |  |
|  |  |
|  |  |
| 13 for resource #1 | 23 for resource #1 | 15 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| powerControlOffset | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 |
| Period (slots) | slot20 | n.a. | slot10 |
| Offset | 1 | n.a. | 2 |
| qcl-InfoPeriodicCSI-RS | n.a. | n.a. | n.a. |
|  |  |  |
| frequencyDomainAllocation | 0001 | 0001 | 0001 |
| nrofPorts | 1 | 1 | 1 |
| firstOFDMSymbolInTimeDomain | 6 for resource #0 | 7 for resource #0 | 6 for resource #0 |
|  |  |
|  |  |
|  |  |
| 10 for resource #1 | 11 for resource #1 | 10 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| cdm-Type | noCDM | noCDM | noCDM |
| density | 3 | 3 | 3 |
| startingRB | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | |

A.3.14.2 TDD

**Table A.3.14.2-1: CSI-RS Reference Measurement Channels for SCS=15kHz**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **CSI-RS.1.1 TDD** | **CSI-RS.1.2 TDD** | **CSI-RS.1.3 TDD** | **CSI-RS.1.4 TDD** | **CSI-RS.1.5 TDD** | **CSI-RS.1.6 TDD** |
| Resource Type | periodic | periodic | aperiodic | aperiodic | **periodic** | periodic |
| **Resource Set Config** |  |  |  |  |  |  |
| nzp-CSI-ResourceSetId | 0 | 0 | 0 | 0 | 0 | 0 |
| repetition | n.a. | off | off | on | n.a. | off |
| aperiodicTriggeringOffset | n.a. | n.a. | 4 | 4 | n.a. | n.a. |
| trs-Info | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |  |  |  |
|  |  | 0 for resource #0 | 0 for resource #0 | 0 for resource #0 |  | 2 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |
|  |  |  |  | 2 for resource #2 |  |
|  |  |  |  | 3 for resource #3 |  |
| nzp-CSI-RS-ResourceId | 0 for resource #0 | 1 for resource #1 | 1 for resource #1 | 4 for resource #4 | 0 for resource #0 | 3 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |
|  |  |  |  | 6 for resource #6 |  |
|  |  |  |  | 7 for resource #7 |  |
| powerControlOffset | 0 | 0 | 0 | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 | 0 | 0 | 0 |
| Period (slots) | slot5 | slot10 | n.a. | n.a. | slot40 | slot10 |
| Offset | 1 | 1 | n.a. | n.a. | 1 | 1 |
| qcl-InfoPeriodicCSI-RS | TCI.State.0 | TCI.State.0 | n.a. | n.a. | TCI.State.0 | TCI.State.0 |
|  |  | TCI.State.1 |  |  |  | TCI.State.1 |
| frequencyDomainAllocation | 000001 | 0001 | 0001 | 0001 | 000001 | 0100 |
| nrofPorts | 2 | 1 | 1 | 1 | 2 | 1 |
|  |  | 6 for resource #0 | 6 for resource #0 | 0 for resource #0 |  | 6 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |
|  |  |  |  | 2 for resource #2 |  |
|  |  |  |  | 3 for resource #3 |  |
| firstOFDMSymbolInTimeDomain | 4 for resource #0 | 10 for resource #1 | 10 for resource #1 | 4 for resource #4 | 5 for resource #0 | 10 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |
|  |  |  |  | 6 for resource #6 |  |
|  |  |  |  | 7 for resource #7 |  |
| cdm-Type | FD-CDM2 | noCDM | noCDM | noCDM | FD-CDM2 | noCDM |
| density | 1 | 3 | 3 | 3 | 1 | 3 |
| startingRB | 0 | 0 | 0 | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | | | | |

**Table A.3.14.2-1A: CSI-RS Reference Measurement Channels for SCS=15kHz**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **CSI-RS.1.1A TDD** | **CSI-RS.1.2A TDD** | **CSI-RS.1.3A TDD** |
| Resource Type | periodic | aperiodic | periodic |
| **Resource Set Config** |  |  |  |
| nzp-CSI-ResourceSetId | 1 | 1 | 1 |
| repetition | off | off | off |
| aperiodicTriggeringOffset | n.a. | 6 | n.a. |
| trs-Info | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for resource #0 | 22 for resource #0 | 14 for resource #0 |
|  |  |
|  |  |
|  |  |
| 13 for resource #1 | 23 for resource #1 | 15 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| powerControlOffset | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 |
| Period (slots) | slot20 | n.a. | slot10 |
| Offset | 1 | n.a. | 2 |
| qcl-InfoPeriodicCSI-RS | n.a. | n.a. | n.a. |
|  |  |  |
| frequencyDomainAllocation | 0001 | 0001 | 0001 |
| nrofPorts | 1 | 1 | 1 |
| firstOFDMSymbolInTimeDomain | 6 for resource #0 | 7 for resource #0 | 6 for resource #0 |
|  |  |
|  |  |
|  |  |
| 10 for resource #1 | 11 for resource #1 | 10 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| cdm-Type | noCDM | noCDM | noCDM |
| density | 3 | 3 | 3 |
| startingRB | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | |

**Table A.3.14.2-2: CSI-RS Reference Measurement Channels for SCS=30kHz**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CSI-RS.2.1 TDD** | **CSI-RS.2.2 TDD** | **CSI-RS.2.3 TDD** | **CSI-RS.2.4 TDD** | **CSI-RS.2.5 TDD** | **CSI-RS.2.6 TDD** | **CSI-RS.2.7 TDD** |
| **Resource Type** | **periodic** | **periodic** | **aperiodic** | **aperiodic** | **aperiodic** | **periodic** | **periodic** |
| **Resource Set Config** |  |  |  |  |  |  |  |
| nzp-CSI-ResourceSetId | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| repetition | n.a. | off | off | on | off | n.a. | off |
| aperiodicTriggeringOffset | n.a. | n.a. | 4 | 4 | 6 | n.a. | n.a. |
| trs-Info | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |  |  |  |  |
|  |  | 0 for resource #0 | 0 for resource #0 | 0 for resource #0 | 0 for resource #0 |  | 2 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |  |
|  |  |  |  | 2 for resource #2 |  |  |
|  |  |  |  | 3 for resource #3 |  |  |
| nzp-CSI-RS-ResourceId | 0 for resource #0 | 1 for resource #1 | 1 for resource #1 | 4 for resource #4 | 1 for resource #1 | 0 for resource #0 | 3 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |  |
|  |  |  |  | 6 for resource #6 |  |  |
|  |  |  |  | 7 for resource #7 |  |  |
| powerControlOffset | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 | db0 | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Period (slots) | slot10 | slot20 | n.a. | n.a. | n.a. | slot80 | slot20 |
| Offset | 2 | 2 | n.a. | n.a. | n.a. | 2 | 2 |
| qcl-InfoPeriodicCSI-RS | TCI.State.0 | TCI.State.0 | n.a. | n.a. | n.a. | TCI.State.0 | TCI.State.0 |
|  |  | TCI.State.1 |  |  |  |  | TCI.State.1 |
| frequencyDomainAllocation | 000001 | 0001 | 0001 | 0001 | 000001 | 000001 | 0100 |
| nrofPorts | 2 | 1 | 1 | 1 | 1 | 2 | 1 |
|  |  | 6 for resource #0 | 6 for resource #0 | 0 for resource #0 | Specified in the test case for resource #0 |  | 6 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |  |
|  |  |  |  | 2 for resource #2 |  |  |
|  |  |  |  | 3 for resource #3 |  |  |
| firstOFDMSymbolInTimeDomain | 5 for resource #0 | 10 for resource #1 | 10 for resource #1 | 4 for resource #4 | n.a. | 5 for resource #0 | 10 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |  |
|  |  |  |  | 6 for resource #6 |  |  |
|  |  |  |  | 7 for resource #7 |  |  |
| cdm-Type | FD-CDM2 | noCDM | noCDM | noCDM | noCDM | FD-CDM2 | noCDM |
| density | 1 | 3 | 3 | 3 | 3 | 1 | 3 |
| startingRB | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | | | | | |

**Table A.3.14.2-2A: CSI-RS Reference Measurement Channels for SCS=30kHz**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **CSI-RS.2.1A TDD** | **CSI-RS.2.2A TDD** | **CSI-RS.2.3A TDD** |
| Resource Type | periodic | aperiodic | periodic |
| **Resource Set Config** |  |  |  |
| nzp-CSI-ResourceSetId | 1 | 1 | 1 |
| repetition | off | off | off |
| aperiodicTriggeringOffset | n.a. | 6 | n.a. |
| trs-Info | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for resource #0 | 22 for resource #0 | 14 for resource #0 |
|  |  |
|  |  |
|  |  |
| 13 for resource #1 | 23 for resource #1 | 15 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| powerControlOffset | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 |
| Period (slots) | slot40 | n.a. | slot20 |
| Offset | 2 | n.a. | 4 |
| qcl-InfoPeriodicCSI-RS | n.a. | n.a. | n.a. |
|  |  |  |
| frequencyDomainAllocation | 0001 | 0001 | 0001 |
| nrofPorts | 1 | 1 | 1 |
| firstOFDMSymbolInTimeDomain | 6 for resource #0 | 7 for resource #0 | 6 for resource #0 |
|  |  |
|  |  |
|  |  |
| 10 for resource #1 | 11 for resource #1 | 10 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| cdm-Type | noCDM | noCDM | noCDM |
| density | 3 | 3 | 3 |
| startingRB | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | |

**Table A.3.14.2-3: CSI-RS Reference Measurement Channels for SCS=120kHz**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **CSI-RS.3.1 TDD** | **CSI-RS.3.2 TDD** | **CSI-RS.3.3 TDD** | **CSI-RS.3.4 TDD** | **CSI-RS.3.5 TDD** | **CSI-RS.3.6 TDD** |
| Resource Type | periodic | periodic | aperiodic | aperiodic | **periodic** | periodic |
| **Resource Set Config** |  |  |  |  |  |  |
| nzp-CSI-ResourceSetId | 0 | 0 | 0 | 0 | 0 | 0 |
| repetition | n.a. | off | off | on | n.a. | off |
| aperiodicTriggeringOffset | n.a. | n.a. | 4 | 4 | n.a. | n.a. |
| trs-Info | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |  |  |  |
|  |  | 0 for resource #0 | 0 for resource #0 | 0 for resource #0 |  | 2 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |
|  |  |  |  | 2 for resource #2 |  |
|  |  |  |  | 3 for resource #3 |  |
| nzp-CSI-RS-ResourceId | 0 for resource #0 | 1 for resource #1 | 1 for resource #1 | 4 for resource #4 | 0 for resource #0 | 3 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |
|  |  |  |  | 6 for resource #6 |  |
|  |  |  |  | 7 for resource #7 |  |
| powerControlOffset | 0 | 0 | 0 | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 | 0 | 0 | 0 |
| Period (slots) | slot40 | slot80 | n.a. | n.a. | slot320 | slot80 |
| Offset | 8 | 8 | n.a. | n.a. | 8 | 8 |
| qcl-InfoPeriodicCSI-RS | TCI.State.0 | TCI.State.0 | n.a. | n.a. | TCI.State.0 | TCI.State.0 |
|  |  | TCI.State.1 |  |  |  | TCI.State.1 |
| frequencyDomainAllocation | 000001 | 0001 | 0001 | 0001 | 000001 | 0100 |
| nrofPorts | 2 | 1 | 1 | 1 | 1 | 1 |
|  |  | 6 for resource #0 | 6 for resource #0 | 0 for resource #0 |  | 6 for resource #0 |
|  |  |  |  | 1 for resource #1 |  |
|  |  |  |  | 2 for resource #2 |  |
|  |  |  |  | 3 for resource #3 |  |
| firstOFDMSymbolInTimeDomain | 5 for resource #0 | 10 for resource #1 | 10 for resource #1 | 4 for resource #4 | 5 for resource #0 | 10 for resource #1 |
|  |  |  |  | 5 for resource #5 |  |
|  |  |  |  | 6 for resource #6 |  |
|  |  |  |  | 7 for resource #7 |  |
| cdm-Type | FD-CDM2 | noCDM | noCDM | noCDM | FD-CDM2 | noCDM |
| density | 1 | 3 | 3 | 3 | 1 | 3 |
| startingRB | 0 | 0 | 0 | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | | | | |

**Table A.3.14.2-3A: CSI-RS Reference Measurement Channels for SCS=120kHz**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **CSI-RS.3.1A TDD** | **CSI-RS.3.2A TDD** | **CSI-RS.3.3A TDD** |
| Resource Type | periodic | aperiodic | periodic |
| **Resource Set Config** |  |  |  |
| nzp-CSI-ResourceSetId | 1 | 1 | 1 |
| repetition | off | off | off |
| aperiodicTriggeringOffset | n.a. | 6 | n.a. |
| trs-Info | n.a. | n.a. | n.a. |
| **Resource Config** |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for resource #0 | 22 for resource #0 | 14 for resource #0 |
|  |  |
|  |  |
|  |  |
| 13 for resource #1 | 23 for resource #1 | 15 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| powerControlOffset | 0 | 0 | 0 |
| powerControlOffsetSS | db0 | db0 | db0 |
| scramblingID | 0 | 0 | 0 |
| Period (slots) | slot160 | n.a. | slot80 |
| Offset | 8 | n.a. | 16 |
| qcl-InfoPeriodicCSI-RS | n.a. | n.a. | n.a. |
|  |  |  |
| frequencyDomainAllocation | 0001 | 0001 | 0001 |
| nrofPorts | 1 | 1 | 1 |
| firstOFDMSymbolInTimeDomain | 6 for resource #0 | 7 for resource #0 | 6 for resource #0 |
|  |  |
|  |  |
|  |  |
| 10 for resource #1 | 11 for resource #1 | 10 for resource #1 |
|  |  |  |
|  |  |  |
|  |  |  |
| cdm-Type | noCDM | noCDM | noCDM |
| density | 3 | 3 | 3 |
| startingRB | 0 | 0 | 0 |
| nrofRBs | 276 (Note 1) | 276 (Note 1) | 276 (Note 1) |
| Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP. | | | |

==========================End of change 3=============================

==========================Start of change 4 =============================

A.3.16A Unified TCI State Configuration

A.3.16A.1 Introduction

This clause provides the configurations for unified TCI states towards either SSB or CSI-RS. The DLorJoint TCI states defined in this clause are configured in each test when applicable to indicate that certain DL (and UL, if joint DL/UL operation is configured) signals are QCL’ed with the referenceSignal configured in the TCI states. The UL TCI states defined in this clause are configured in each test when applicable to indicate that certain UL signals are QCL’ed with the referenceSignal configured in the TCI states.

A.3.16A.2 DLorJoint TCI states

**Table A.3.16A.2-1: DLorJoint TCI States**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **DLorJoint TCI.State.0** | **DLorJoint TCI.State.1** | **DLorJoint TCI.State.2** | **DLorJoint TCI.State.3** |
| tci-StateUnifiedId | Id0 | Id1 | Id2 | Id3 |
| qcl-Type1 | typeA | typeA | typeA | typeA |
| qcl-Type2Note1 | typeD | typeD | typeD | typeD |
| referenceSignal Note2 | Resource #4 in TRS resource set 1 Note3 | Resource #4 in TRS resource set 2 Note3 | Resource #4 in TRS resource set 1 Note3 | Resource #4 in TRS resource set 2 Note3 |
| pathlossReferenceRS | N/A | N/A | Resource #4 in TRS resource set 1 Note3 | Resource #4 in TRS resource set 2 Note3 |
| additionalPCI | N/A | configured Note4 | N/A | N/A |
| Note 1: qcl-Type2 of typeD only where applicable. For RRM test cases, this will be only in FR2  Note 2: referenceSignal configurations towards which the TCI states are configured are defined in a test-specific manner.  Note 3: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1.  Note 4: Only one PCI than serving cell PCI is included in the additionalPCIList, and the additionalPCIIndex is configured as 0. | | | | |

A.3.16A.3 UL TCI states

**Table A.3.16A.3-1: UL TCI States**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **UL TCI.State.0** | **UL TCI.State.1** | **UL TCI.State.2** | **UL TCI.State.3** |
| ul-TCIState-Id | Id0 | Id1 | Id2 | Id3 |
| referenceSignal Note1 | SSB0 | SSB1 | Resource #4 in TRS resource set 1 Note2 | Resource #4 in TRS resource set 2 Note2 |
| pathlossReferenceRS | Resource #4 in TRS resource set 1 Note2 | Resource #4 in TRS resource set 2 Note2 | Resource #4 in TRS resource set 1 Note2 | Resource #4 in TRS resource set 2 Note2 |
| additionalPCI | N/A | N/A | N/A | N/A |
| Note 1: referenceSignal configurations towards which the UL TCI states are configured are defined in a test-specific manner.  Note 2: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. | | | | |

==========================End of change 4=============================

==========================Start of change 5 =============================

# A.4 EN-DC tests with all NR cells in FR1

## A.4.5 Signaling characteristics

### A.4.5.5 Beam Failure Detection and Link recovery procedures

#### A.4.5.5.X7 EN-DC TRP specific Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in non-DRX mode

##### A.4.5.5.X7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the TRP specific SSB-based beam failure in the set (q0,0), (q0,1) configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set (q1,0) and (q1,1). The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.X7.1-1, A.4.5.5.X7.1-2, A.4.5.5.X7.1-3 and A.4.5.5.X7.1-4 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the active PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.X7.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the SSB in set q0 in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.X7.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

**Table A.4.5.5.X7.1-1: Supported test configurations for FR1 PCell**

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.5.X7.1-2: General test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | | Unit | Value | Value | Comment |
| Active E-UTRA PCell | | | | |  | Cell 1 | Cell 1 |  |
| E-UTRA RF Channel Number | | | | |  | 1 | 1 |  |
|  | | | | |  | TRP 1 | TRP 2 |  |
| Active PSCell | | | | |  | Cell 2 | Cell 2 |  |
| RF Channel Number | | | | |  | 2 | 2 |  |
| Duplex mode | | | | Config 1, 4 |  | FDD | FDD |  |
|  | | | | Config 2, 3, 5, 6 |  | TDD | TDD |  |
| BWchannel | | | | Config 1, 4 | MHz | 10: NRB,c = 52 | 10: NRB,c = 52 |  |
|  | | | | Config 2, 5 |  | 10: NRB,c = 52 | 10: NRB,c = 52 |  |
|  | | | | Config 3, 6 |  | 40: NRB,c = 106 | 40: NRB,c = 106 |  |
| DL initial BWP configuration | | | | Config 1, 2, 3, 4, 5, 6 |  | DLBWP.0.1 | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | | | Config 1, 2, 3, 4, 5, 6 |  | DLBWP.1.1 | DLBWP.1.1 |  |
| UL initial BWP configuration | | | | Config 1, 2, 3, 4, 5, 6 |  | ULBWP.0.1 | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | | | Config 1, 2, 3, 4, 5, 6 |  | ULBWP.1.1 | ULBWP.1.1 |  |
| TDD | | | | Config 1, 4 |  | Not Applicable | Not Applicable |  |
| Configuration | | | | Config 2, 5 |  | TDDConf.1.1 | TDDConf.1.1 |  |
|  | | | | Config 3, 6 |  | TDDConf.2.1 | TDDConf.2.1 |  |
| CORESET | | | | Config 1, 4 |  | CR.1.1 FDD | CR.1.1 FDD |  |
| RMSI CORESET | | | | Config 1, 4 |  | CR.1.1 FDD | CR.1.1 FDD |  |
| Reference | | | | Config 2, 5 |  | CR.1.1 TDD | CR.1.1 TDD |  |
| Channel | | | | Config 3, 6 |  | CR.2.1 TDD | CR.2.1 TDD |  |
| Dedicated CORESET | | | | Config 1, 4 |  | CCR.1.1 FDD | CCR.1.1 FDD |  |
| Reference | | | | Config 2, 5 |  | CCR.1.1 TDD | CCR.1.1 TDD |  |
| SSB Configuration | | | | Config 1, 4 |  | SSB.3 FR1 | SSB.7 FR1 |  |
|  | | | | Config 2, 5 |  | SSB.3 FR1 | SSB.7 FR1 |  |
|  | | | | Config 3, 6 |  | SSB.4 FR1 | SSB.8 FR1 |  |
| SMTC Configuration | | | | Config 1, 2, 4, 5 |  | SMTC.1 | SMTC.1 |  |
|  | | | | Config 3, 6 |  | SMTC.1 | SMTC.1 |  |
| PDSCH/PDCCH subcarrier | | | | Config 1, 2, 4, 5 |  | 15 KHz | 15 KHz |  |
| spacing | | | | Config 3, 6 |  | 30 KHz | 30 KHz |  |
| PRACH Configuration | | | | Config 1, 2, 4, 5 |  | Table A.3.8.2.2-1 | Table A.3.8.2.2-1 |  |
|  | | | | Config 3, 6 |  | Table A.3.8.2.2-1 | Table A.3.8.2.2-1 |  |
| SSB Index assigned as BFD RS (q0,0) | | | | |  | 0 | - |  |
| SSB Index assigned as CBD RS (q1,0) | | | | |  | 1 | - |  |
| SSB Index assigned as BFD RS (q0,1) | | | | |  | - | 2 |  |
| SSB Index assigned as CBD RS (q1,1) | | | | |  | - | 3 |  |
| OCNG parameters | | | | |  | OP.1 | OP.1 |  |
| CP length | | | | |  | Normal | Normal |  |
| Correlation Matrix and Antenna Configuration | | | | |  | 2x2 Low | 2x2 Low |  |
| Beam failure | | | DCI format | |  | 1-0 | 1-0 |  |
| detection transmission parameters | | | Number of Control OFDM symbols | |  | 2 | 2 |  |
|  | | | Aggregation level | | CCE | 8 | 8 |  |
|  | | | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | | dB | 0 | 0 |  |
|  | | | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | | dB | 0 | 0 |  |
|  | | | DMRS precoder granularity | |  | REG bundle size | REG bundle size |  |
|  | | | REG bundle size | |  | 6 | 6 |  |
| DRX | | | | |  | OFF | OFF |  |
| Gap pattern ID | | | | |  | gp0 | gp0 |  |
| gapOffset | | | | |  | 0 | 0 |  |
| rlmInSyncOutOfSyncThreshold | | | | |  | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | Config 1, 2, 4, 5 | | | dBm/SCS kHz | -98 | -98 | Threshold used for Qin\_LR\_SSB |
|  | | Config 3, 6 | | |  | -95 | -95 |  |
| powerControlOffsetSS | | | | |  | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | | |  | n1 | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | | | |  | pbfd4 | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS | | | Config 1, 4 | |  | CSI-RS.1.1 FDD | CSI-RS.1.1 FDD |  |
| configuration for | | | Config 2, 5 | |  | CSI-RS.1.1 TDD | CSI-RS.1.1 TDD |  |
| CSI reporting | | | Config 3, 6 | |  | CSI-RS.2.1 TDD | CSI-RS.2.1 TDD |  |
| CSI-RS for | | | Config 1, 4 | |  | TRS.1.1 FDD | TRS.1.1 FDD |  |
| tracking | | | Config 2, 5 | |  | TRS.1.1 TDD | TRS.1.1 TDD |  |
|  | | | Config 3, 6 | |  | TRS.1.2 TDD | TRS.1.2 TDD |  |
| SSB Index assigned as RLM RS | | | | |  | 0,1 | 2,3 |  |
| T310 timer | | | | | ms | 1000 | 1000 |  |
| N310 | | | | |  | 2 | 2 |  |
| T1 | | | | | s | 0.2 | 0.2 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | | | | s | TBD | TBD |  |
| T3 | | | | | s | TBD | TBD |  |
| T4 | | | | | s | TBD | TBD |  |
| T5 | | | | | s | TBD | TBD |  |
| D1 | | | | | s | TBD | TBD |  |
|  | Note 1: All configurations are assigned to the UE prior to the start of time period T1.  Note 2: UE-specific PDCCH is not transmitted after T1 starts.  Note 3: E-UTRAN is in non-DRX mode under test. | | | | | | | |

Table A.4.5.5.X7.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | | | | |
| 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 | 0 | | | | |
| 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\_SSB of set q0,0 | Config 1, 4 | dB | TBD | TBD | TBD | TBD | TBD |
|  | Config 2, 5 |  | TBD | TBD | TBD | TBD | TBD |
|  | Config 3, 6 |  | TBD | TBD | TBD | TBD | TBD |
| SNR\_SSB of set q0,1 | Config 7,10 | dB | TBD | TBD | TBD | TBD | TBD |
|  | Config 8, 11 |  | TBD | TBD | TBD | TBD | TBD |
|  | Config 9, 12 |  | TBD | TBD | TBD | TBD | TBD |
| SNR\_SSB of set q1,0 | Config 1, 4 | dB | TBD | TBD | TBD | TBD | TBD |
|  | Config 2, 5 |  | TBD | TBD | TBD | TBD | TBD |
|  | Config 3, 6 |  | TBD | TBD | TBD | TBD | TBD |
| SNR\_SSB of set q1,1 | Config 7, 10 | dB | TBD | TBD | TBD | TBD | TBD |
|  | Config 8, 11 |  | TBD | TBD | TBD | TBD | TBD |
|  | Config 9, 12 |  | TBD | TBD | TBD | TBD | TBD |
| SSB\_RP of set q1,0 | Config 1, 4 | dBm/SCS | -108 | -108 | -88 | -88 | -88 |
|  | Config 2, 5 | kHz | -108 | -108 | -88 | -88 | -88 |
|  | Config 3, 6 |  | -105 | -105 | -85 | -85 | -85 |
| SSB\_RP of set q1,1 | Config 7, 10 | dBm/SCS | -108 | -108 | -88 | -88 | -88 |
| Config 8, 11 | kHz | -108 | -108 | -88 | -88 | -88 |
| Config 9, 12 |  | -105 | -105 | -85 | -85 | -85 |
|  | Config 1, 4 | dBm/15 KHz | -98 | | | | |
|  | Config 2, 5 |  | -98 | | | | |
|  | Config 3, 6 |  | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| 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: Measurement gap configuration is assigned to the UE prior to the start of time period T1.  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 SSS REs.  Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.  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. | | | | | | | |



**Figure A.4.5.5.X7.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode**

##### A.4.5.5.X7.2 Test Requirements

Test requirements are applied to TRP specific report respectively on (q0,0), (q0,1) for TRP 1 and (q1,0), (q1,1) for TRP 2 repectively as Figure A.4.5.5.X7.1-1.

The UE behaviour during time durations T1, T2, T3, T4 and T5 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.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q1,0 and q1,1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q1. The UE shall not transmit preamble on a beam associated with the candidate beam set q1 earlier than time point B.

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%.

A.4.5.5.X8 EN-DC TRP specific Beam Failure Detection and Link Recovery Test for FR1 SCell configured with CSI-RS-based BFD and SSB-based LR in non-DRX mode

A.4.5.5.X8.1 Test Purpose and Environment

The test scenario is EN-DC and a NR SCell configured in the test contains two TRPs (i.e., TRP0 and TRP1). Each TRP is configured with different CSI-RS and SSB for beam failure detection and candidate beam detection. CSI-RS is configured as BFD-RS and SSB is configured as CBD-RS.

The purpose of this test is to verify that the UE properly detects the CSI-RS-based beam failure on the TRP using the respective configured BFD set for TRP0 and for TRP1. After the BFD is detected for the TRP, the test further verifies whether the UE performs the correct SSB-based link recovery based on the configured beam candicate set for TRP0 and for TRP1. In the test one TRP (TRP0) is provided with schedulingRequestID-BFR-r17 and other TRP (TRP1) is not provided with scheduling request ID. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.18.

Supported test configuration are provided in Table A.4.5.5.X8.2-1, general test parameters for FR1 SCell is provided in Table A.4.5.5.X8.2-2, and Cell specific test parameter are provided in Table A.4.5.5.X8.2-3. There are three cells in the test, cell 1 is the E-UTRAN PCell, cell 2 is the NR PSCell and cell 3 is the NR SCell. CSI report for SCell (cell 3) are transmitted on PSCell (cell 2).

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.X8.2-1 shows the SNR of the CSI-RS in set q0,0 in the TRP0 to emulate beam failure. Figure A.4.5.5.X8.2-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q10 and q11 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1, cell 2 and cell3. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

**Table A.4.5.5.X8.2-1: Supported test configurations for FR1 PCell and SCell**

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.5.X8.2-2:** **General test parameters for FR1 SCell for beam failure detection and link recovery testing in non-DRX mode**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | | **Unit** | **Value** | **Comment** |
|  | | | |  | **Test 1** | Same configuration for both TRP whereever applicbale |
| Active PCell | | | |  | Cell 1 |  |
| E-UTRA RF Channel Number | | | |  | 1 |  |
| Active PSCell | | | |  | Cell 2 |  |
| RF Channel Number for PSCell | | | |  | 2 |  |
| Active SCell | | | |  | Cell 3 |  |
| RF Channel Number for SCell | | | |  | 3 |  |
| Duplex mode | | | Config 1, 4 |  | FDD |  |
|  | | | Config 2, 3, 5, 6 |  | TDD |  |
| BW channel | | | Config 1, 4 |  | 10: NRB,c = 52 |  |
|  | | | Config 2, 5 | MHz | 10: NRB,c = 52 |  |
|  | | | Config 3, 6 |  | 40: NRB,c = 106 |  |
| DL initial BWP configuration | | | Config 1, 2, 3, 4, 5, 6 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | | Config 1, 2, 3, 4, 5, 6 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | | Config 1, 2, 3, 4, 5, 6 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | | Config 1, 2, 3, 4, 5, 6 |  | ULBWP.1.1 |  |
| TDD Configuration | | | Config 1, 4 |  | Not Applicable |  |
|  | | | Config 2, 5 |  | TDDConf.1.1 |  |
|  | | | Config 3, 6 |  | TDDConf.2.1 |  |
| CORESET | | | Config 1, 4 |  | CR.1.1 FDD | A.3.1.2 |
| Reference Channel | | | Config 2, 5 |  | CR.1.1 TDD |  |
|  | | | Config 3, 6 |  | CR.2.1 TDD |  |
| SSB Configuration | | | Config 1, 4 |  | SSB.1 FR1 | A.3.10 |
|  | | | Config 2, 5 |  | SSB.1 FR1 | Same configuration for both TRP |
|  | | | Config 3, 6 |  | SSB.2 FR1 |  |
| SMTC Configuration | | | Config 1, 2, 3, 4, 5, 6 |  | SMTC.1 | A.3.11, Same configuration for both TRP |
| PDSCH/PDCCH | | | Config 1, 2, 4, 5 | kHz | 15 |  |
| subcarrier spacing | | | Config 3, 6 |  | 30 |  |
| PRACH Configuration | | | Config 1, 2, 4, 5 |  | Table A.3.8.2.2-1 |  |
| Config 3, 6 |  | Table A.3.8.2.2-1 |  |
| csi-RS-Index assigned as beam failure detection RS in set q00 in activated SCell | | | |  | 0 |  |
| csi-RS-Index assigned as beam failure detection RS in set q01 in activated SCell | | | |  | 2 |  |
| 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 | | | |  | OFF |  |
| Gap pattern ID | | | |  | N.A. |  |
| schedulingRequestID-BFR-r17 | | | |  | Configured, 1-2 |  |
| schedulingRequestID-BFR2-r17 | | | |  | absent | When the field is absent, the random access procedure will be triggered for TRP BFR |
| Periodicity of PUCCH for SR configuration for BFR on TRP0 | | | | Slot | 5 |  |
| SSB Index assigned as CBD RS (q10) in activated SCell | | | |  | 1 |  |
| SSB Index assigned as CBD RS (q11) in activated SCell | | | |  | 3 |  |
| rlmInSyncOutOfSyncThreshold | | | |  | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp- | Config 1, 2, 4, 5 | | | dBm/SCS | -98 | Threshold used |
| ThresholdBFR | Config 3, 6 | | |  | -95 | for Qin\_LR\_SSB |
| 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 |
| CBD-RS (CSI-RS)  configuration for q10 in activated SCell | | Config 1, 4 | |  | SSB.3 FR1 | A.3.14 |
| Config 2, 5 | | SSB.3 FR1 |
| Config 3, 6 | | SSB.4 FR1 |
| CBD-RS (CSI-RS)  configuration for q11 in activated SCell | | Config 1, 4 | |  | SSB.7 FR1 | A.3.14 |
| Config 2, 5 | | SSB.7 FR1 |
| Config 3, 6 | | SSB.8 FR1 |
| BFD-RS (CSI-RS) | | | Config 1, 4 |  | CSI-RS.1.2 FDD | A.3.14 |
| configuration for q00 in activated SCell | | | Config 2, 5 |  | CSI-RS.1.2 TDD |  |
|  | | | Config 3, 6 |  | CSI-RS.2.2 TDD |  |
| BFD-RS (CSI-RS)  configuration for q01 in activated SCell | | | Config 1, 4 |  | CSI-RS.1.7 FDD | A.3.14 |
| Config 2, 5 | CSI-RS.1.6 TDD |
| Config 3, 6 | CSI-RS.2.7 TDD |
| CSI-RS | | | Config 1, 4 |  | CSI-RS.1.1 FDD | A.3.14 |
| configuration for | | | Config 2, 5 |  | CSI-RS.1.1 TDD |  |
| CSI reporting | | | Config 3, 6 |  | CSI-RS.2.1 TDD |  |
| TRS configuration | | | Config 1, 4 |  | TRS.1.1 FDD |  |
|  | | | Config 2, 5 |  | TRS.1.1 TDD |  |
|  | | | Config 3, 6 |  | TRS.1.2 TDD |  |
| csi-RS-Index | | | Config 1, 4 |  | CSI-RS.1.2 FDD | A.3.14 |
| assigned as RLM | | | Config 2, 5 |  | CSI-RS.1.2 TDD |  |
| RS in PSCell | | | Config 3, 6 |  | CSI-RS.2.2 TDD |  |
| T310 Timer | | | | ms | 1000 |  |
| N310 | | | |  | 2 |  |
| T1 | | | | s | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | | | s | 0.18 |  |
| T3 | | | | s | 0.14 |  |
| T4 | | | | s | 0 |  |
| T5 | | | | s | 0.17 |  |
| D1 | | | | s | 0.13 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | | |

**Table A.4.5.5.X8.2-3: Cell specific test parameters for FR1 PSCell and SCell for beam failure detection and link recovery testing in non-DRX mode**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell2** | **TRP 0/1 Cell3** | | | | |
|  | |  | **T1 to T5** | **T1** | **T2** | **T3** | **T4** | **T5** |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  |  | | | | |
| 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 | 0 | 0 | | | | |
| 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 q00 | Config 1, 4 | dB | 5 | 5 | -3 | -12 | -12 | -12 |
|  | Config 2, 5 |  | 5 | 5 | -3 | -12 | -12 | -12 |
|  | Config 3, 6 |  | 5 | 5 | -3 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q01 | Config 1, 4 |  | 5  5  5 | 5  5  5 | 5  5  5 | 5  5  5 | 5  5  5 | 5  5  5 |
| Config 2, 5 |
| Config 3, 6 |
| SNR\_SSB of set q10 | Config 1, 4 | dB | -10 | -10 | -10 | 10 | 10 | 10 |
|  | Config 2, 5 |  | -10 | -10 | -10 | 10 | 10 | 10 |
|  | Config 3, 6 |  | -10 | -10 | -10 | 10 | 10 | 10 |
| SSB\_RP of set q10 | Config 1, 4 | dBm/SCS kHz | -108 | -108 | -108 | -88 | -88 | -88 |
|  | Config 2, 5 |  | -108 | -108 | -108 | -88 | -88 | -88 |
|  | Config 3, 6 |  | -105 | -105 | -105 | -85 | -85 | -85 |
|  | Config 1, 4 | dBm/15 kHz | -98 | -98 | | | | |
|  | Config 2, 5 |  | -98 | -98 | | | | |
|  | Config 3, 6 |  | -98 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | TDL-C 300ns 100Hz | | | | |
| 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.4.5.5.1.1-1.  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]. | | | | | | | | |

Graphical user interface, application

Description automatically generated

Figure A.4.5.5.X8.2-1: SNR and L1-RSRP variation for beam failure detection and link recovery testing for TRP0 in non-DRX mode

A.4.5.5.X8.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 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 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure on both TRP0 and TRP 1 and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q1,0 and q1,1.

For TRP0, no later than time point F occurring no later than D1 = [60] ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q1,0. The UE shall not transmit PUCCH with an LRR with the candidate beam set q1,0 earlier than time point B.

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

==========================Start of change 5 =============================

==========================Start of change 6 =============================

# A.5 EN-DC tests with one or more NR cells in FR2

## A.5.5 Signaling characteristics

### A.5.5.5 Beam Failure Detection and Link recovery procedures

#### A.5.5.5.X8 EN-DC TRP specific Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in DRX mode

##### A.5.5.5.X8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the TRP specific CSI-RS-based beam failure in the set (q0,0), (q0,1) configured for a serving PSCell and a cell with PCID different from the serving cell, and that the UE performs correct CSI-RS-based link recovery based on beam candidate set (q1,0) and (q1,1). The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.X8.1-1, A.5.5.5.X8.1-2, A.5.5.5.X8.1-3, and A.5.5.5.X8.1-4 below. There are three cells, cell 1 is the E-UTRAN PCell, cell 2 is the PSCell and cell 3 is the cell with different PCID in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.X.5.5.4.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set q0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.4.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, 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.X.5.5.X.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode |

Table A.X.5.5.X.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** |  | **Comment** |
|  | |  |  | **Test 1** |  |  |
| Active E-UTRA PCell | | 1-2 |  | Cell 1 | |  |
| E-UTRA RF Channel Number | | 1-2 |  | 1 | |  |
| Active PCell | | 1-2 |  | Cell 2 – TRP1 |  |  |
| Cell with additional PCI | | 1-2 |  |  | Cell 3 – TRP2 | Different CID |
| RF Channel Number | | 1-2 |  | 2 | 2 |  |
| Duplex mode | | 1-2 |  | TDD | TDD |  |
| TDD Configuration | | 1-2 |  | TDDConf.3.1 | TDDConf.3.1 |  |
| BWchannel | | 1-2 |  | 100: NRB,c = 66 | 100: NRB,c = 66 |  |
| Data RBs allocated | | 1-2 |  | 66 | 66 |  |
| PDSCH/PDCCH subcarrier spacing | | 1-2 | kHz | 120 | 120 |  |
| DL initial BWP configuration | | 1-2 |  | DLBWP.0.1 | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | 1-2 |  | DLBWP.1.1 | DLBWP.1.1 |  |
| UL initial BWP configuration | | 1-2 |  | ULBWP.0.1 | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | 1-2 |  | ULBWP.1.1 | ULBWP.1.1 |  |
| PDSCH Reference Channel | | 1-2 |  | SR.3.2 TDD | SR.3.2 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | CR.3.1 TDD |  |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD | CCR.3.1 TDD |  |
| OCNG parameters | | 1-2 |  | OP.1 | OP.1 |  |
| CP length | | 1-2 |  | Normal | Normal |  |
| PDSCH/PDCCH TCI state | | 1-2 |  | TCI.State.0 | TCI.State.0 |  |
| CSI-RS for tracking | | 1-2 |  | TRS.2.1 TDD | TRS.2.1 TDD |  |
| SSB Configuration | | 1-2 |  | SSB.1 FR2 | SSB.1 FR2 |  |
| SMTC Configuration | | 1-2 |  | SMTC.3 | SMTC.3 |  |
| PRACH Configuration | | 1-2 |  | FR2 PRACH configuration 4 | FR2 PRACH configuration 4 | A.3.8.3.4 |
| DRX configuration | | 1-2 |  | DRX.3 | DRX.3 | A.3.3.3 |
| CSI-RS configuration for BFD/CBD/RLM | | 1-2 |  | CSI-RS.3.2 TDD | CSI-RS.3.2 TDD | A.3.14.2 |
| CSI-RS index assigned as BFD RS (q0,0) | | 1-2 |  | CSI-RS#0 | - |  |
| CSI-RS index assigned as CBD RS (q1,0) | | 1-2 |  | CSI-RS#1 | - |  |
| CSI-RS index assigned as BFD RS (q0,1) | | 1-2 |  | - | CSI-RS#2 |  |
| CSI-RS index assigned as CBD RS (q1,1) | | 1-2 |  | - | CSI-RS#3 |  |
| CSI-RS index assigned as RLM RS | | 1-2 |  | 0,1 | 3,4 |  |
| Beam failure detection transmission parameters | DCI format | 1-2 |  | 1-0 | 1-0 |  |
| Number of Control OFDM symbols | 1-2 |  | 2 | 2 |  |
| Aggregation level | 1-2 | CCE | 8 | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 1-2 | dB | 0 | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 1-2 | dB | 0 | 0 |  |
| DMRS precoder granularity | 1-2 |  | REG bundle size | REG bundle size |  |
| REG bundle size | 1-2 |  | 6 | 6 |  |
| Gap pattern ID | | 1-2 |  | N/A | N/A |  |
| rlmInSyncOutOfSyncThreshold | | 1-2 |  | absent | absent | Value 0 is applied. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -95 | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | 1-2 |  | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-2 |  | n1 | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | 1-2 |  | pbfd4 | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-2 |  | CSI-RS.3.1 TDD | CSI-RS.3.1 TDD | A.3.14.2 |
| reportConfigType | | 1-2 |  | periodic | periodic |  |
| reportQuantity | | 1-2 |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI |  |
| CSI reporting periodicity | | 1-2 | slot | 40 | 40 |  |
| CSI reporting offset | | 1-2 | slot | 4 | 4 |  |
| T310 | | 1-2 | ms | 1000 | 1000 |  |
| N310 | | 1-2 |  | 2 | 2 |  |
| T1 | | 1-2 | s | 1 | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1-2 | s | TBD | TBD |  |
| T3 | | 1-2 | s | TBD | TBD |  |
| T4 | | 1-2 | s | TBD | TBD |  |
| T5 | | 1-2 | s | TBD | TBD |  |
| D1 | | 1-2 | s | TBD | TBD |  |
|  | Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

Table A.X.5.5.X.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 3 defined in A.3.15 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | | | | |
| 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 | 0 | | | | |
| 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 | Config 1-2 | dB | TBD | TBD | TBD | TBD | TBD |
| SNR\_CSI-RS of set q1,0 | Config 1-2 | dB | TBD | TBD | TBD | TBD | TBD |
| SNR\_CSI-RS of set q0,1 | Config 1-2 | dB | TBD | TBD | TBD | TBD | TBD |
| SNR\_CSI-RS of set q1,1 | Config 1-2 | dB | TBD | TBD | TBD | TBD | TBD |
| CSI-RS\_RP of set q1,0 | Config 1-2 | dBm/SCS | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
| CSI-RS\_RP of set q1,1 | Config 1-2 | dBm/SCS | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
|  | Config 1-2 | 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 SSS REs.  Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.4.1-1.  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: This value allows up to 1dB degradation from applied SNR to UE baseband | | | | | | | |

图表, 箱线图

描述已自动生成

**Figure A.X.5.5.X.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

##### A.5.5.5.X8.2 Test Requirements

Test requirements are applied to TRP specific report respectively on (q0,0), (q0,1) for cell-2 and (q1,0), (q1,1) for cell-3 repectively as Figure A.X.5.5.X.1-1.

The UE behaviour during time durations T1, T2, T3, T4 and T5 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.

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

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q1. The UE shall not transmit preamble on a beam associated with the candidate beam set q1 earlier than time point B.

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%.

==========================Start of change 6 =============================

==========================Start of change 7 =============================

### A.5.5.X Unified TCI state switch delay

#### A.5.5.X.1 MAC-CE based active joint TCI state switch

A.5.5.X.1.1 E-UTRAN – NR PSCell FR2 active joint TCI state switch for a known TCI state

###### A.5.5.X.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based joint TCI state switch delay requirement defined in clause 8.15.3 and 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping. Supported test configuration is shown in Table A.5.5.X.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.5.5.X.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.2-1 and cell-specific parameters of NR PSCell is specified in Table A.5.5.X.1.1.2-1 below. The OTA related test parameters for FR2 are shown in Table A.5.5.X.1.1.2-2.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Table A.5.5.X.1.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

Table A.5.5.X.1.1.1-2: General test parameters for TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel No. |  | Channel 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel No. |  | Channel 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| L1-RSRP reporting period |  | 160 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0, SSB1 | L1-RSRP measurements of SSB0 and SSB1. |
| Number of RS for L1-RSRP reporting |  | 2 | L1-RSRP reporting of measurements on SSB0 and SSB1. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

###### A.5.5.X.1.1.2 Test parameters

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).

- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE’s higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *joint.*

- UE is configured with 2 different DLorJoint States for PSCell, Joint TCI state 0 (QCL’d to SSB0) and Joint TCI state 1 (QCL’d to SSB1) before starting the test,

- UE is indicated in Joint TCI state 0 as the active joint TCI state.

The test consists of two time periods, T1 and T2. Figure A.7.5.x.y.1.1-1 and Figure A.7.5.x.y.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB0 to which Joint TCI state 0 is QCL’d is transmitted. At the beginning of T2, the SSB1 corresponding to Joint TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to Joint TCI state 1.The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The test equipment verifies that UE shall be able to receive and transmit with Joint TCI state 0 until slot n+ THARQ +, and shall be able to receive and transmit with Joint TCI state 1 from slot n+ THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*.

Table A.5.5.X.1.1.2-1: NR Cell specific test parameters for TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 1 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3. 2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP. 5 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| Joint TCI State 0 |  | DLorJoint TCI.State.0 |
| Joint TCI State 1 |  | DLorJoint TCI.State.1 |
| TRS Configuration |  | TRS.2.1 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table A.5.5.X.1.1.2-2: OTA related test parameters for TCI state switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| SSB#0 | | SSB#1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beams Note 6 |  | Rough for SSB reception | | | |
| NocNote 1 | dBm/15 kHz | -92.1 | | | |
| NocNote 1 | dBm/SCS | -83.1 | | | |
| Ês/Noc | dB | 1 | 1 | -Infinity | 1 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.1 | -82.1 | -Infinity | -82.1 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -50.6 | -50.6 | -54.1 | -50.6 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation. | | | | | |

###### A.5.5.X.1.1.3 Test Requirements

The test verifies that UE can be scheduled by PSCell on Joint TCI state 0 and Joint TCI state 1.

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to receive and transmit with Joint TCI state 0 until slot n+ THARQ +

- be able to start receiving and transmitting with Joint TCI state 1 after slot n+ THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*

The rate of correct events observed during repeated tests shall be at least [90]%.

*Editor’ note: FFS whether the rate of correct event should be added.*

#### A.5.5.X.2 MAC-CE based active uplink TCI state switch

##### A.5.5.X.2.1 E-UTRAN – NR PSCell FR2 active uplink TCI state switch for a known TCI state

###### A.5.5.X.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based uplink TCI state switch delay requirement defined in clause 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping. Supported test configurations are shown in Table A.5.5.X.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.5.5.X.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.2-1 and cell-specific parameters of NR PSCell is specified in Table A.5.5.X.2.1.2-1 below. The OTA related test parameters for FR2 is shown in Table A.5.5.X.2.1.2-2.

Table A.5.5.X.2.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

Table A.5.5.X.2.1.1-2: General test parameters for spatial relation switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel No. |  | Channel 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel No. |  | Channel 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| L1-RSRP reporting period | slot | 160 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0, SSB1 | L1-RSRP measurements of SSB0 and SSB1. |
| Number of reported RS |  | 2 | L1-RSRP reporting of measurements on SSB0 and SSB1. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

###### A.5.5.X.2.1.2 Test parameters

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC);

- PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have continuous ACK/NACK sending by PUCCH;

- UE is provided with *TCI-UL-State-r17* and UE’s higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *separate*;

- UE is configured with 2 different uplink TCI states for PSCell, PUCCH uplink TCI state 0 (associated with SSB0) and uplink TCI state 1 (associated with SSB1), by using RRC signalling *ul-TCI-StateList-r17* in IE *BWP-UplinkDedicated*, in Cell 2 before starting the test;

- UE is indicated uplink TCI state 0 as the active PUCCH uplink TCI state.

The test consists of two time periods, T1 and T2. During T1 only SSB#0 with which PUCCH uplink TCI state 0 is associated is transmitted. At the beginning of T2, the SSB#1 corresponding to uplink TCI state 1 starts transmitting. After the beginning of T2, in slot *n* which is within 1280ms of UE providing L1-RSRP report with results for both SSB#0 and SSB#1, UE receives a MAC-CE command indicating a switch to transmit PUCCH with uplink TCI state 1. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

Index of CSI-RS#1 is configured for UE as *PUSCH-PathlossReferenceRS-Id-r17* which is indicated in *TCI-UL-State-r17* of uplink TCI state 1. CSI-RS#1 is QCLed typeD with SSB#1. UE does not maintain CSI-RS#1 as pathloss RS before the uplink TCI state switching.

Table A.5.5.X.2.1.2-1: NR Cell specific test parameters for uplink TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 2 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| PL-RS Configuration  (CSI-RS#1) |  | Resource #4 in TRS.2.2 TDD |
| Uplink TCI State 0 |  | UL TCI.State.0 |
| Uplink TCI State 1 |  | UL TCI.State.1 |
| TRS Configuration |  | TRS.2.1 TDD |
| reportQuantity for SSB |  | ssb-Index-RSRP-Index-r17 |
| reportConfigType for SSB |  | periodic |
| reportQuantity for CSI-RS |  | cri-RSRP-Index-r17 |
| reportConfigType for CSI-RS |  | periodic |
| timeRestrictionForChannelMeasurements |  | configured |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH |
| EPRE ratio of OCNG DMRS to SSS (Note 1) |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table A.5.5.X.2.1.2-2: OTA related test parameters for uplink spatial relation switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| SSB#0 | | SSB#1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beams Note 6 |  | Rough for SSB reception | | | |
| NocNote 1 | dBm/15 kHz | -92.1 | | | |
| NocNote 1 | dBm/SCS | -83.1 | | | |
| Ês/Noc | dB | 1 | 1 | -Infinity | 1 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.1 | -82.1 | -Infinity | -82.1 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -50.6 | -50.6 | -54.1 | -50.6 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation. | | | | | |

###### A.5.5.X.2.1.3 Test Requirements

The test verifies that UE can be scheduled by PSCell on uplink TCI state 0 and uplink TCI state 1. The test also verifies the active uplink TCI state switch time in PSCell meeting the requirement defined in 8.16.3. Specifically,

During T2, UE shall send L1-RSRP report with results for SSB#1 before sending MAC-CE command.

After receiving MAC-CE command in slot *n* in T2, UE shall:

- be able to continue to transmit PUCCH on uplink TCI state 0 till slot *n* + THARQ + ;

- be able to start transmitting PUCCH on uplink TCI state 1 from slot *n* + THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length* and onwards.

#### A.5.5.X.3 MAC-CE based active downlink TCI state switch

##### A.5.5.X.3.1 E-UTRAN – NR PSCell FR2 downlink TCI state switch to cell with additional PCI for a known TCI state

###### A.5.5.X.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the active DL TCI state switch delay requirement for unified TCI defined in clause 8.15.3. Supported test configurations are shown in Table A.5.5.X.3.1.1-1.

Table A.5.5.X.3.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

###### A.5.5.X.3.1.2 Test Parameters

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2), and one NR cell with additional PCI different from from serving cell (Cell 3) configured for intercell L1-RSRP measurement and report as given in Table A.5.5.X.3.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and cell with additional PCI are specified in Table A.5.5.X.3.1.1-3 below. The OTA related test parameters for FR2 is shown in Table A.5.5.X.3.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) and cell with additional PCI (Cell 3) to ensure that the UE would have ACK/NACK transmission.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC), Cell 3 (Cell with additional PCI) in radio channel 3.

* UE is provided with *dl-OrJoint-TCIStateList-r17* and UE’s higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *seperate*;

- UE is configured with L1-RSRP measurements on cell with additional PCI (Cell 3)

- UE is configured with 2 different TCI states for PSCell, PDCCH TCI state 0 (QCL’d to TRS resource set 1, TCI state of which is QCLed to SSB0 of Cell2) and TCI state 1 (QCL’d to TRS resource set 3, TCI state of which is QCLed to SSB1 of Cell3), in Cell 2 before starting the test.

- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. Figure A.5.5.X.3.1.1-1 and Figure A.5.5.X.3.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL’d is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 of cell 2 and SSB1 of cell 1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PSCell on TCI state 0 till n+ THARQ +3 ms. The test equipment also verifies the TCI state switch time in to cell with additional PCI by scheduling the UE on TCI state 1 after n+ THARQ +3 ms + (Tfirst-SSB + TSSB-proc) .

Table A.5.5.X.3.1.1-2: General test parameters for TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| Cell with addiitonal PCI |  | Cell 3 | Cell on RF channel number 3. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

Table A.5.5.X.3.1.1-3: NR Cell specific test parameters for TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | Cell 3 |
| Frequency Range |  | FR2 | FR2 |
| Duplex mode |  | TDD | TDD |
| TDD configuration |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 | 100 MHz: NRB,c = 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3. 2 TDD | SR.3. 2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD | CCR.3.1 TDD |
| OCNG Patterns |  | OP. 5 | OP. 5 |
| SSB Configuration |  | SSB.1 FR2 | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 | SMTC.1 |
| TCI State 0 |  | DLorJoint TCI.State.0 | N/A |
| TCI State 1 |  | N/A | DLorJoint TCI.State.1 |
| TRS Configuration |  | TRS.2.1 TDD | TRS.2.2 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  |
| Propagation Condition |  | AWGN | AWGN |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table A.5.5.X.3.1.1-4: OTA related test parameters for TCI state switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | Cell 3 | |
|  |  | SSB0 | | SSB1 | |
|  |  | T1 | T2 | T1 | T2 |
| Angle of arrival |  | Setup 3 according to clause A.3.15.3 | | | |
| configuration |  | AoA1 | | AoA2 | |
| Ês | dBm/SCS | -80.6 | -80.6 | -Infinity | -80.6 |
| SS B\_RP Note 2 | dBm/ SCS | -80.6 | -80.6 | - Infinity | -80.6 |
| BB Note 7 | dB | 8.3 | 8.3 | -Infinity | 8.3 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.0 | -56.0 | - Infinity | -50.0 |
| Note 1: Void  Note 2: SS B\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Void  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation  Note 7: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | |



Figure A.5.5.X.3.1.1-1: Time multiplexed downlink transmissions during T1



Figure A.5.5.X.3.1.1-2: Time multiplexed downlink transmissions during T2

###### A.5.5.X.3.1.3 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n+ THARQ +3

- be able to start receiving on TCI state 1 after n+ THARQ +(5 ms + Tfirst-SSB) / *NR slot length*

The rate of correct events observed during repeated tests shall be at least 90%.

*Editor’ note: FFS whether the rate of correct event should be added.*

==========================End of change 7 =============================

==========================Start of change 8 =============================

# A.6 NR standalone tests with all NR cells in FR1

## A.6.5 Signalling characteristics

### A.6.5.5 Beam Failure Detection and Link recovery procedures

#### A.6.5.5.X7 TRP Specific Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in DRX mode

##### A.6.5.5.X7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects TRP specific CSI-RS-based beam failure in the sets q0,0  and q0,1  configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q1,0 andq1,1. The purpose is to test the downlink monitoring for beam failure detection on TRP1 within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based TRP specific beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.18.

The test parameters are given in Tables A.6.5.5.X7.1-1, A.6.5.5.X7.1-2, A.6.5.5.X7.1-3, and A.6.5.5.X7.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.X7.1-1 shows the variation of the downlink SNR of the CSI-RS in set q0,0  and q0,1  for TRP1 and TRP2 respectively to emulate CSI-RS based beam failure on TRP1. Figure A.6.5.5.X7.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q1,0 andq1,1 of the candidate beam used for link recovery. 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 5 ms. In the test, 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.6.5.5.X7.1-1: Supported test configurations for FR1 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth |
| 3 | TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Table A.6.5.5.X7.1-2: General test parameters for FR1 PCell for CSI-RS-based TRP specific beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value | | | Value | Comment | |
|  | | |  | TRP1 | | | TRP2 |  | |
| Active PCell | | |  | Cell 1 | | | Cell 1 |  | |
| RF Channel Number | | |  | 1 | | | 1 |  | |
| Duplex mode | Config 1 | |  | FDD | | | FDD |  | |
|  | Config 2, 3 | |  | TDD | | | TDD |  | |
| TDD Configuration | Config 1 | |  | Not Applicable | | | Not Applicable |  | |
|  | Config 2 | |  | TDDConf.1.1 | | | TDDConf.1.1 |  | |
|  | Config 3 | |  | TDDConf.2.1 | | | TDDConf.2.1 |  | |
| RMSI CORESET Reference Channel | Config 1 | |  | CR.1.1 FDD | | | CR.1.1 FDD | A.3.1.2 | |
|  | Config 2 | |  | CR.1.1 TDD | | | CR.1.1 TDD |  | |
|  | Config 3 | |  | CR.2.1 TDD | | | CR.2.1 TDD |  | |
| Dedicated CORESET Reference Channel | Config 1 | |  | CCR.1.1 FDD | | | CCR.1.1 FDD | A.3.1.3 | |
|  | Config 2 | |  | CCR.1.1 TDD | | | CCR.1.1 TDD |  | |
|  | Config 3 | |  | CCR.2.1 TDD | | | CCR.2.1 TDD |  | |
| SSB Configuration | Config 1 | |  | SSB. 3 FR1 | | | SSB. 3 FR1 | A.3.10 | |
|  | Config 2 | |  | SSB. 3 FR1 | | | SSB. 3 FR1 |
|  | Config 3 | |  | SSB. 4 FR1 | | | SSB. 4 FR1 |
| SMTC Configuration | Config 1, 2 | |  | SMTC.1 | | | SMTC.1 | A.3.11 | |
|  | Config 3 | |  | SMTC.1 | | | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | |  | 15 KHz | | | 15 KHz |  | |
|  | Config 3 | |  | 30 KHz | | | 30 KHz |  | |
| PRACH  Configuration | Config 1, 2 | |  | FR1 PRACH configuration 4 | | | FR1 PRACH configuration 4 | A.3.8.2 | |
| Config 3 | |  | FR1 PRACH configuration 4 | | | FR1 PRACH configuration 4 | A.3.8.2 | |
| OCNG parameters | | |  | OP.1 | | | OP.1 | A.3.2.1 | |
| CP length | | |  | Normal | | | Normal |  | |
| Correlation Matrix and Antenna Configuration | | |  | 2x2 Low | | | 2x2 Low |  | |
| Beam failure detection transmission parameters | DCI format | |  | 1-0 | | | 1-0 |  | |
|  | Number of Control OFDM symbols | |  | 2 | | | 2 |  | |
|  | Aggregation level | | CCE | 8 | | | 8 |  | |
|  | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | dB | 0 | | | 0 |  | |
|  | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | dB | 0 | | | 0 |  | |
|  | DMRS precoder granularity | |  | REG bundle size | | | REG bundle size |  | |
|  | REG bundle size | |  | 6 | | | 6 |  | |
| DRX | | |  | DRX.7 | | | DRX.7 | A.3.3.7 | |
| Gap pattern ID | | |  | N.A. | | | N.A. |  | |
| rlmInSyncOutOfSyncThreshold | | |  | absent | | | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). | |
| rsrp-ThresholdSSB | | Config 1, 2 | dBm/SCS kHz | -98 | | |  | Threshold used for Qin\_LR\_SSB | |
| Config 3 |  | -95 | | |  |  | |
| powerControlOffsetSS | | |  | db0 | | | db0 | Used for deriving rsrp-ThresholdCSI-RS | |
| beamFailureInstanceMaxCount | | |  | n1 | | | n1 | see clause 5.17 of TS 38.321 [7] | |
| beamFailureDetectionTimer | | |  | pbfd4 | | | pbfd4 | see clause 5.17 of TS 38.321 [7] | |
| CSI-RS configuration for BFD/CBD/RLM | Config 1 | |  | CSI-RS.1.2 FDD | | | CSI-RS.1.7 FDD | A.3.14.1 | |
| Config 2 | |  | CSI-RS.1.2 TDD | | | CSI-RS.1.6 TDD |  | |
| Config 3 | |  | CSI-RS.2.2 TDD | | | CSI-RS.2.7 TDD |  | |
| CSI-RS index assigned as BFD RS | | |  | | 0 | 2 | | |  |
| CSI-RS index assigned as CBD RS | | |  | | 1 | 3 | | |  |
| CSI-RS index assigned as RLM RS | | |  | | 0,1 | 0,1 | | |  |
| CSI-RS configuration for CSI reporting | Config 1 | |  | CSI-RS.1.1 FDD | | | CSI-RS.1.1 FDD | A.3.14.1 | |
| Config 2 | |  | CSI-RS.1.1 TDD | | | CSI-RS.1.1 TDD |  | |
| Config 3 | |  | CSI-RS.2.1 TDD | | | CSI-RS.2.1 TDD |  | |
| TRS configuration | Config 1 | |  | TRS.1.1 FDD | | | TRS.1.1 FDD |  | |
| Config 2 | |  | TRS.1.1 TDD | | | TRS.1.1 TDD |  | |
| Config 3 | |  | TRS.1.2 TDD | | | TRS.1.2 TDD |  | |
| CSI-RS-Index assigned as RLM RS | Config 1 | |  | CSI-RS.1.2 FDD | | | CSI-RS.1.2 FDD |  | |
| Config 2 | |  | CSI-RS.1.2 TDD | | | CSI-RS.1.2 TDD |  | |
| Config 3 | |  | CSI-RS.2.2 TDD | | | CSI-RS.2.2 TDD |  | |
| T310 Timer | | | ms | 1000 | | | 1000 |  | |
| N310 | | |  | 2 | | | 2 |  | |
| T1 | | | s | 1 | | | 1 | During this time the the UE shall be fully synchronized to cell 1 | |
| T2 | | | s | [10.81] | | | [10.81] |  | |
| T3 | | | s | [10.28] | | | [10.28] |  | |
| T4 | | | s | 0 | | | 0 |  | |
| T5 | | | s | [0.57] | | | [0.57] |  | |
| D1 | | | s | [0.53] | | | [0.53] |  | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | | | | | |

Table A.6.5.5.X7.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| 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 | Config 1 | dB | 5 | -3 | -12 | -12 | -12 |
|  | Config 2 |  | 5 | -3 | -12 | -12 | -12 |
|  | Config 3 |  | 5 | -3 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q0,1 | Config 1 | dB | 5 | 5 | 5 | 5 | 5 |
|  | Config 2 |  | 5 | 5 | 5 | 5 | 5 |
|  | Config 3 |  | 5 | 5 | 5 | 5 | 5 |
| SNR\_CSI-RS of set q1,0 | Config 1 | dB | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
|  | Config 2 |  | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
|  | Config 3 |  | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
| CSI-RS\_RP of set q1,0 | Config 1 | dB/SCS kHz | -110 | -110 | -88 | -88 | -88 |
|  | Config 2 |  | -110 | -110 | -88 | -88 | -88 |
|  | Config 3 |  | -107 | -107 | -85 | -85 | -85 |
|  | Config 1 | dBm/15 KHz | -98 | | | | |
|  | Config 2 |  | -98 | | | | |
|  | Config 3 |  | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| 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.4.5.5.1.1-1.  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. | | | | | | | |

Chart

Description automatically generated with medium confidence

**Figure A.6.5.5.X7.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

##### A.6.5.5.X7.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 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.

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

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q1,0.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q1,0. The UE shall not transmit preamble on a beam associated with the candidate beam set q1,0 earlier than time point B.

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 8=============================

==========================Start of change 9 =============================

## A.6.6 Measurement procedure

### A.6.6.4 L1-RSRP measurement for beam reporting

A.6.6.4.X Inter-cell SSB based L1-RSRP measurements on FR1 PCell when DRX is used

A.6.6.4.X.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement in a cell with PCI different from serving cell. This test will partly verify the L1-RSRP measurement requirements in clause 9.13.4.1, with the testing configurations for NR serving cells in Table A.6.6.4.X.1-1.

**Table A.6.6.4.X.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test**

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

A.6.6.4.X.2 Test parameters

There are two cells in the test, the FR1 PCell (Cell 1) and a cell with PCI different from serving cell (Cell 2). The test parameters for the Cell 1 are given in Table A.6.6.4.X.2-1. The test parameters for Cell 2 are given in Table A.6.6.4.X.2-2 below.

SSB#0 and SSB#1 are transmitted on Cell 1 and Cell 2. In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSB#0 and report measurement results periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. At the beginning of T2, SSB#1 starts transmission and the UE is configured for L1-RSRP measurement on SSB#1. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured in CSI-ReportConfigand *additionalPCIList* configured in *CSI-SSB-ResourceSet.*

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the the SSB#0 for Cell 1.

**Table A.6.6.4.X.2-1: General test parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **Value** |
| Active cell | 1~3 |  | Cell 1 |
| A cell with different PCI | 1~3 |  | Cell 2 |
| RF Channel Number | 1~3 |  | 1: Cell 1 and Cell 2 |
| SSB GSCN | 1~3 |  | freq1 |
| Duplex mode | 1 |  | FDD |
|  | 2 |  | TDD |
|  | 3 |  | TDD |
| TDD Configuration | 1 |  | N/A |
|  | 2 |  | TDDConf.1.1 |
|  | 3 |  | TDDConf.2.1 |
| BWchannel | 1 | MHz | 10: NRB,c = 52 |
|  | 2 |  | 10: NRB,c = 52 |
|  | 3 |  | 40: NRB,c = 106 |
| PDSCH Reference measurement channel | 1 |  | SR.1.1 FDD |
|  | 2 |  | SR.1.1 TDD |
|  | 3 |  | SR.2.1 TDD |
| RMSI CORESET Reference Channel | 1 |  | CR.1.1 FDD |
|  | 2 |  | CR.1.1 TDD |
|  | 3 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | 1 |  | CCR.1.1 FDD |
|  | 2 |  | CCR.1.1 TDD |
|  | 3 |  | CCR.2.1 TDD |
| SSB configuration | 1 |  | SSB.3 FR1 for Cell1 and Cell2 |
|  | 2 |  | SSB.3 FR1 for Cell1 and Cell2 |
|  | 3 |  | SSB.4 FR1 for Cell1 and Cell2 |
| OCNG Patterns | 1~3 |  | OP.1 |
| Initial BWP Configuration | 1~3 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~3 |  | DLBWP.1.1  ULBWP.1.1 |
| SMTC configuration | 1~3 |  | SMTC.1 |
| TRS Configuration | 1 |  | TRS.1.1 FDD |
|  | 2 |  | TRS.1.1 TDD |
|  | 3 |  | TRS.1.2 TDD |
| DRX configuration | 1~3 |  | DRX.3 |
| reportConfigType | 1~3 |  | periodic |
| reportQuantity | 1~3 |  | ssb-Index-RSRP |
| Number of reported RS | 1~3 |  | 2 |
| L1-RSRP reporting period | 1~3 | slot | 80 |
| T1 | 1~3 | s | 5 |
| T2 | 1~3 | s | 1 |
| CP length | 1~3 |  | Normal |
| EPRE ratio of PSS to SSS | 1~3 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |
| EPRE ratio of PDSCH to PDSCH DMRS |  |  |  |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  |  |
| Propagation condition | 1~3 |  | AWGN |
| Time offset between serving and a cell with different PCI | 1 |  | < CP |
| 2 |  | < CP |
| 3 |  | < CP |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

**Table A.6.6.4.X.2-2: SSB specific test parameters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **SSB#0 of Cell 1** | | **SSB#1 of Cell 2** | |
|  |  |  | **T1** | **T2** | **T1** | **T2** |
| Note2 | 1~3 | dBm/15kHz | -94.65 | | | |
| Note2 | 1,2 | dBm/SSB SCS | -94.65 | | | |
|  | 3 |  | -91.65 | | | |
|  | 1~3 | dB | 0 | 0 | -Infinity | 3 |
| SSB RSRP Note3 | 1,2 | dBm/SSB SCS | -94.65 | -94.65 | -Infinity | -91.65 |
|  | 3 |  | -91.65 | -91.65 | -Infinity | -88.65 |
| Io Note3 | 1,2 | dBm/9.36 MHz | -63.69 | -63.69 | -66.70 | -61.93 |
|  | 3 | dBm/38.16 MHz | -57.59 | -57.59 | -60.61 | -55.84 |
|  | 1~3 | dB | 0 | 0 | -Infinity | 3 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

A.6.6.4.X.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of SSB#1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

==========================End of change 9=============================

==========================Start of change 10 =============================

# A.7 NR standalone tests with one or more NR cells in FR2

## A.7.5 Signaling characteristics

### A.7.5.5 Beam Failure Detection and Link recovery procedures

#### A.7.5.5.X8 TRP specific Beam Failure Detection and Link Recovery Test for FR2 SCell configured with CSI-RS-based BFD and LR in DRX mode

##### A.7.5.5.X8.1 Test Purpose and Environment

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

The test parameters are given in Tables A.7.5.5.X8.1-1, A.7.5.5.X8.1-2 and A.7.5.5.X8.1-3. There are two cell, cell 1 is the active PCell and cell 2 is the active SCell, in the test. SCell 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.X8.1-1shows the variation of the downlink SNR of the CSI-RS in set and in the active SCell for TRP1 and TRP2 respectively. Figure A.7.5.5.X8.1-1additionally shows the variation of the downlink L1-RSRP of the CSI-RS in for TPR1. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, 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.X8.1-1: Supported test configurations for FR2 PCell and SCell

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

Table A.7.5.5.X8.1-2: General test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | TRP1 | TRP2 | Comment |
| Active PCell | |  | Cell 1 | Cell 1 |  |
| RF Channel Number | |  | 1 | 1 |  |
| Active SCell | |  | Cell 2 | Cell 2 |  |
| RF Channel Number | |  | 2 | 2 |  |
| Duplex mode | Config 1 |  | TDD | TDD |  |
| TDD Configuration | Config 1 |  | TDDConf.3.1 | TDDConf.3.1 |  |
| CORESET Reference Channel | Config 1 |  | CR.3.1 TDD | CR.3.1 TDD | A.3.1.2 |
| SSB Configuration | Config 1 |  | SSB.3 FR2 | SSB.3 FR2 | A.3.10 |
| SMTC Configuration | Config 1 |  | SMTC.3 | SMTC.3 | A.3.11 |
| PDSCH/PDCCH subcarrier spacing | Config 1 |  | 120 KHz | 120 KHz |  |
| PRACH Configuration | Config 1 |  | Table A.3.8.3.1-1 | Table A.3.8.3.1-1 |  |
| TRS configuration | |  | TRS.2.1 TDD | TRS.2.1 TDD |  |
| TCI configuration | |  | CSI-RS.Config.0 | CSI-RS.Config.0 |  |
| OCNG parameters | |  | OP.1 | OP.1 | A.3.2.1 |
| CP length | |  | Normal | Normal |  |
| Correlation Matrix and Antenna Configuration | |  | 2x2 Low | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format |  | 1-0 | 1-0 |  |
| Number of Control OFDM symbols |  | 2 | 2 |  |
| Aggregation level | CCE | 8 | 1-0 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |  |
| DMRS precoder granularity |  | REG bundle size | REG bundle size |  |
| REG bundle size |  | 6 | 6 |  |
| DRX | |  | DRX.3 | DRX.3 | A.3.3.3 |
| Gap pattern ID | |  | N.A. | N.A. |  |
| schedulingRequestID-BFR-SCell-r16 | |  | Configured | Configured |  |
| Periodicity of PUCCH for SR configuration for BFR on SCell | | slots | 40 | 40 | 5ms |
| Offset of PUCCH for SR configuration for BFR on SCell | | slots | 5 | 5 |  |
| PUCCH parameters for SR configuration for BFR on SCell | |  | Table 8.3.3.1.2-1 in [13] | Table 8.3.3.1.2-1 in [13] |  |
| rlmInSyncOutOfSyncThreshold | |  | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdBFR | | dBm/SCS kHz | -95 | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | |  | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | |  | n1 | n1 | see clause 5.17 of TS 38.321 [7] |
| beamFailureDetectionTimer | |  | pbfd4 | pbfd4 | see clause 5.17 of TS 38.321 [7] |
| CSI-RS configuration for BFD/CBD/RLM | |  | CSI-RS.3.2 TDD | CSI-RS.3.6 TDD | A.3.14.2 |
| CSI-RS index assigned as BFD RS | |  | 0 | 0 |  |
| CSI-RS index assigned as CBD RS | |  | 1 | 1 |  |
| CSI-RS index assigned as RLM RS | |  | 0,1 | 0,1 |  |
| CSI-RS configuration for CSI reporting | |  | CSI-RS.3.1 TDD | CSI-RS.3.1 TDD | A.3.14.2 |
| T310 Timer | | ms | 1000 | 1000 |  |
| N310 | |  | 2 | 2 |  |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | [10.81] | [10.81] |  |
| T3 | | s | [10.28] | [10.28] |  |
| T4 | | s | 0 | 0 |  |
| T5 | | s | [0.57] | [0.57] |  |
| D1 | | s | [0.53] | [0.53] |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |  |

Table A.7.5.5.X8.1-3: Cell specific test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | **Cell1** | Cell2 | | | | |
|  | **T1 to T5** | T1 | T2 | T3 | T4 | T5 |
| AoA setup |  | Setup 3 as specified in clause A.3.15 Note 11 | | | | | |
| Assumption for UE beams Note 10 |  | Rough | 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 | 0 |
| 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 | 5 | -3 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1,0 | dB | 5 | 5 | 5 | 5 | 5 | 5 |
| SNR\_CSI-RS of set q0,1 | dB | 0.2 | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
| CSI-RS\_RP of set q0,1 | dBm/  SCS kHz | -104.5 | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
| Noc | dBm/120 kHz | -104.7 | -104.7 | | | | |
| Propagation condition |  | TDL-A 30ns 75Hz | 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 for PCell and TRP1 of SCell , AoA2 for TRP2 of SCell | | | | | | | |



**Figure A.7.5.5.X8.1-1: SNR and L1-RSRP variation for beam failure detection and link recovery testing for SCell in DRX mode**

##### A.7.5.5.X8.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 in A.7.5.5.X8.1 and T5 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 for TRP1 and TRP2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 TRP1 and TRP2 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 for TRP2.

During T3 the UE shall detect beam failure and initiate link recovery for TRP1. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q0,1.

No later than time point F occurring no later than D1 = [520]+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q0,1. The UE shall not transmit PUCCH with an LRR with the candidate beam set q0,1 earlier than time point B.

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%.

#### A.7.5.5.X9 TRP specific Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

##### A.7.5.5.X9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects TRP specific SSB-based beam failure and link recovery in the sets and for TRP1 when no DRX is used for an FR2 serving cell requirements in clause 8.18.

The test parameters are given in Tables A.7.5.5.X9.1-1, A.7.5.5.X9.1-2, A.7.5.5.X9.1-3 and A.7.5.5.X9.1-4 below. There is one active serving cell configured with two TRPs in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.X9.1-1 shows the variation of the downlink SNR of the SSB in set and for TRP1 and TRP2 respectively. Figure A.7.5.5.X9.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set for TPR1.

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 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

Table A.7.5.5.X9.1-1: Supported test configurations for FR2 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 2 | TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

Table A.7.5.5.X9.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **TRP1** | **TRP2** | **Comment** |
|  | |  |  |  |  |  |
| Active PCell | | 1-2 |  | Cell 1 | Cell 1 |  |
| RF Channel Number | | 1-2 |  | 1 | 1 |  |
| Duplex mode | | 1-2 |  | TDD | TDD |  |
| TDD Configuration | | 1-2 |  | TDDConf.3.1 | TDDConf.3.1 |  |
| BWchannel | | 1-2 |  | 100: NRB,c = 66 | 100: NRB,c = 66 |  |
| Data RBs allocated | | 1-2 |  | 66 | 66 |  |
| PDSCH/PDCCH subcarrier spacing | | 1-2 | kHz | 120 | 120 |  |
| DL initial BWP configuration | | 1-2 |  | DLBWP.0.1 | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | 1-2 |  | DLBWP.1.1 | DLBWP.1.1 |  |
| UL initial BWP configuration | | 1-2 |  | ULBWP.0.1 | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | 1-2 |  | ULBWP.1.1 | ULBWP.1.1 |  |
| PDSCH Reference Channel | | 1 |  | SR.3.2 TDD | SR.3.2 TDD |  |
| 2 | SR.3.3 TDD | SR.3.3 TDD |  |
| RMSI CORESET Reference Channel | | 1 |  | CR.3.1 TDD | CR.3.1 TDD |  |
| 2 | CR.3.2 TDD | CR.3.2 TDD |  |
| Dedicated CORESET Reference Channel | | 1 |  | CCR.3.1 TDD | CCR.3.1 TDD |  |
| 2 | CCR.3.7 TDD | CCR.3.7 TDD |  |
| OCNG parameters | | 1-2 |  | OP.1 | OP.1 |  |
| CP length | | 1-2 |  | Normal | Normal |  |
| PDSCH/PDCCH TCI state | | 1-2 |  | TCI.State.0 | TCI.State.0 |  |
| CSI-RS for tracking | | 1-2 |  | TRS.2.1 TDD | TRS.2.1 TDD |  |
| SSB Configuration | | 1 |  | SSB.1 FR2 | SSB.9 FR2 |  |
| 2 | SSB.2 FR2 | SSB.10 FR2 |  |
| SMTC Configuration | | 1-2 |  | SMTC.3 | SMTC.3 |  |
| PRACH Configuration | | 1-2 |  | FR2 PRACH configuration 2 | FR2 PRACH configuration 2 | A.3.8.3.2 |
| DRX configuration | | 1-2 |  | OFF | OFF |  |
| SSB index assigned as BFD RS | | 1-2 |  | 0 | 2 |  |
| SSB index assigned as CBD RS | | 1-2 |  | 1 | 3 |  |
| SSB index assigned as RLM RS | | 1-2 |  | 0,1 | 2,3 |  |
| Beam failure detection transmission parameters | DCI format | 1-2 |  | 1-0 | 1-0 |  |
| Number of Control OFDM symbols | 1-2 |  | 2 | 2 |  |
| Aggregation level | 1-2 | CCE | 8 | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 1-2 | dB | 0 | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 1-2 | dB | 0 | 0 |  |
| DMRS precoder granularity | 1-2 |  | REG bundle size | REG bundle size |  |
| REG bundle size | 1-2 |  | 6 | 6 |  |
| Gap pattern ID | | 1-2 |  | gp0 | gp0 |  |
| gapOffset | | 1-2 | ms | 0 | 0 |  |
| rlmInSyncOutOfSyncThreshold | | 1-2 |  | absent | absent | Value 0 is applied. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1 | dBm/SCS | -95 | -95 | Threshold used for Qin\_LR\_SSB |
| 2 | -92 | -92 |
| powerControlOffsetSS | | 1-2 |  | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-2 |  | n1 | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | 1-2 |  | pbfd4 | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-2 |  | CSI-RS.3.1 TDD | CSI-RS.3.1 TDD |  |
| reportConfigType | | 1-2 |  | periodic | periodic |  |
| reportQuantity | | 1-2 |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI |  |
| CSI reporting periodicity | | 1-2 | slot | 40 | 40 |  |
| CSI reporting offset | | 1-2 | slot | 4 | 4 |  |
| T310 | | 1-2 | ms | 1000 | 1000 |  |
| N310 | | 1-2 |  | 2 | 2 |  |
| T1 | | 1-2 | s | 1 | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1-2 | s | 2.61 | 2.61 |  |
| T3 | | 1-2 | s | 1.64 | 1.64 |  |
| T4 | | 1-2 | s | 0 | 0 |  |
| T5 | | 1-2 | s | 1.01 | 1.01 |  |
| D1 | | 1-2 | s | 0.97 | 0.97 |  |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.  Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | | | | |

Table A.7.5.5.X9.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 3 as specified in clause A.3.15 Note 12 | | | | |
| 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\_SSB of set q0,0 | Config 1-2 | dB | 5Note 11 | -3Note 11 | -12 | -12 | -12 |
| SNR\_SSB of set q1,0 | Config 1-2 | dB | 5Note 11 | 5Note 11 | 5Note 11 | 5Note 11 | 5Note 11 |
| SNR\_SSB of set q0,1 | Config 1-2 | dB | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
|  | Config 1 | dBm/  SCS | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
| SSB\_RP of set q0,1 |
|  | Config 2 | -101.5 | -101.5 | -81.5 | -81.5 | -81.5 |
|  | Config 1,2 | 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: Measurement gap configuration is assigned to the UE prior to the start of time period T1.  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 SSS REs.  Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.1.1-1.  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: This value allows up to 1dB degradation from applied SNR to UE baseband  Note 12: AoA1 for TRP1 and AoA2 for TRP2 | | | | | | | |

**Table A.7.5.5.X9.1-4: Void**



**Figure A.7.5.5.X9.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode**

##### A.7.5.5.X9.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 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 for TRP 1 and TRP2.

During the period from time point A to time point B the UE shall transmit uplink signal for TRP 1 and TRP2 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 for TRP 2.

During T3 the UE shall detect beam failure and initiate link recovery for TRP 1. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q0,1.

No later than time point F occurring no later than D1 = [960]+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q0,1 for TRP1. The UE shall not transmit preamble on a beam associated with the candidate beam set q0,1 earlier than time point B.

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 10 =============================

==========================Start of change 11 =============================

### A.7.5.Y Unified TCI state switching delay

#### A.7.5.Y.1 MAC-CE based active joint TCI state switching

A.7.5.Y.1.1 NR PCell FR2 active joint TCI state switch for a known TCI state

A.7.5.Y.1.1.1 Test Purpose and Environment

The purpose of this test is to verify both active downlink and uplinke TCI state switch delay requirement defined in clause 8.15 and 8.16, respectively, by using joint TCI state of unified TCI state switch framework. In this test, the target TCI state is not in the active TCI state list for PDSCH/PDCCH, and UE is capable of beam correspondence without the need for UL beam sweeping, i.e. *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1. Supported test configuration is shown in Table A.7.5.Y.1.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in Table A.7.5.Y.1.1.1-2. Cell-specific parameters of NR PCell are specified in Table A.7.5.Y.1.1.2-1 below. The OTA related test parameters for FR2 are shown in Table A.7.5.Y.1.1.2-2.

Table A.7.5.Y.1.1.1-1: Supported test configurations

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

Table A.7.5.Y.1.1.1-2: General test parameters for TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| L1-RSRP reporting period | slot | 160 | Periodic L1-RSRP reporting configured |
| Number of RS for L1-RSRP reporting |  | 2 | Two source RSs in TCI state 0 and 1. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

A.7.5.Y.1.1.2 Test parameters

Before the test starts,

* UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
* PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.
* UE is provided with *dl-OrJoint-TCIStateList-r17* and UE’s higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *joint*;
* UE is configured with 2 different joint TCI states for PCell, TCI state 0 (QCL’d to SSB0) and TCI state 1 (QCL’d to SSB1), and the TCI state 1 is not in the active TCI state list for PDSCH/PDCCH.
* UE is indicated TCI state 0 as the active PDCCH TCI state
* Index of CSI-RS#0 is configured for UE as *pathlossReferenceRS-Id-r17* which is indicated in *dl-OrJoint-TCIStateList-r17* of TCI state 0. CSI-RS#0 is QCLed typeD with SSB0. CSI-RS#0 as pathloss RS is maintained by UE.

*Editor note’s: FFS whether the CSi-RS #0 is “maintained” or “not configured”.*

The test consists of two time periods, T1 and T2. During T1 only source RS in TCI state 0 is transmitted. At the beginning of T2, source RS in TCI state 1 start transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280ms after the slot in which UE provides L1-RSRP report with results for both source RSs in TCI state 0 and 1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies the following UE behavior for joint TCI state switch:

* UE shall be able to receive and transmit with TCI state 0 until slot slot *n* + THARQ + , and
* receive and transmit with TCI state 1 from slot n+THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*

Index of CSI-RS#1 is configured for UE as *pathlossReferenceRS-Id-r17* which is indicated in *dl-OrJoint-TCIStateList-r17* of TCI state 1. CSI-RS#1 is QCLed typeD with SSB1. UE maintains CSI-RS#1 as pathloss RS before the test starts.

Table A.7.5.Y.1.1.2-1: NR Cell specific test parameters for TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 1 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3. 2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP. 5 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| PL-RS Configuration  (CSI-RS#1) |  | Resource #4 in TRS.2.2 TDD |
| TCI State 0 |  | DLorJoint TCI.State.2 |
| TCI State 1 |  | DLorJoint TCI.State.3 |
| TRS Configuration |  | TRS.2.1 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table A.7.5.Y.1.1.2-2: OTA related test parameters for TCI state switch

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | | | | |
|  |  | Source RS in TCI state 0 | | Source RS in TCI state 1 | | |
|  |  | T1 | T2 | T1 | | T2 |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | | |
|  |  | AoA1 | | | AoA2 | |
| Assumption for UE beams Note 6 |  | Rough | | | | |
| Ês | dBm/SCS | -80.6 | -80.6 | -Infinity | | -80.6 |
| SS B\_RP Note 2 | dBm/ SCS | -80.6 | -80.6 | -Infinity | | -80.6 |
| BB Note 7 | dB | 8.3 | 8.3 | -Infinity | | 8.3 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.0 | -56.0 | - Infinity | | -56.0 |
| Note 1: Void  Note 2: SS B\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Void  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.  Note 7: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | | |

A.7.5.Y.1.1.3 Test Requirements

The test verifies that UE can be scheduled by PCell on TCI state 0 and TCI state 1.

During T2, UE shall send L1-RSRP report with results for source RSs in both TCI state 0 and 1.

After receiving MAC-CE command in slot n, UE shall:

- be able to receive and transmit with TCI state 0 until slot n + THARQ +

- be able to start receiving and transmitting with TCI state 1 after slot n + THARQ + 3 + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*

The rate of correct events observed during repeated tests shall be at least [90]%.

*Editor’ note: FFS whether the rate of correct event should be added.*

#### A.7.5.Y.2 MAC-CE based active uplink TCI state switch

A.7.5.Y.2.1 NR FR2 PCell uplink TCI state switch for a known TCI state

A.7.5.Y.2.1.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of the uplink TCI switch delay requirement defined in clause 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping. The test scenario comprises one PCell (Cell 1).

Throughout the test, PDCCH indicating new transmissions shall be sent continuously on PCell to ensure that the UE will send ACK/NACKs on PUCCH.

Before the test starts,

* UE is connected to Cell 1 on radio channel 1.
* UE is configured with a unified DL TCI state, TCI State-0, and SSB0 is configured as QCL source for the TCI state. At the start of test UE is connected to DL TCI state 0.
* UE is configured with 2 UL TCI states, UL TCI state 0 and UL TCI state 1. QCL info to UL TCI state 0 and 1 is provided by SSB0 and SSB1, respectively. Initially only UL TCI 0 is in the active TCI states.
* PL-RS is configured for each of the UL TCI states. CSI-RS 0 and CSI-RS 1 are associated with UL TCI state 0 and 1 respectively as PL-RS.
* AT the start of the test UE connected to DL TCI state 0 and UL TCI state 0.

Index of CSI-RS#1 is configured for UE as PUSCH-PathlossReferenceRS-Id-r17 which is indicated in TCI-UL-State-r17 of uplink TCI state 1. CSI-RS#1 is QCLed typeD with SSB#1. UE does not maintain CSI-RS#1 as pathloss RS before the uplink TCI state switching.

The test consists of two time periods, T1 and T2. During T1, only the SSB associated with DL TCI state-0 and UL TCI state 0 is transmitted. At the beginning of T2, transmission of the SSB 1 associated with UL TCI state 1 starts. The UE conducts periodic L1-RSRP (i.e., *SSB-Index-RSRP)* reporting for SSB0 and SSB1. In slot *n*, which is within 1280ms after UE receiving both SSB0 and SSB1, and after reporting valid results for both the SSB0 and the SSB1, the UE receives a MAC-CE indicating a TCI state switch to UL TCI state 1.

The test equipment verifies that the UE transmits according to UL TCI state 0 up until slot *n* + THARQ/NR slot length + , and according to UL TCI state 1 from slot *n* + THARQ/NR slot length + + NM*\** (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms and onwards. NM is equal to 1. Where, THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

A.7.5.Y.2.1.2 Test parameters

The supported test configurations are provided in Table A.7.5.Y.2.1.2-1.

General test parameters are provided in Table A.7.5.Y.2.1.2-2.

Cell-specific parameters are provided in Table A.7.5.Y.2.1.2-3.

OTA-related test parameters are provided in Table A.7.5.Y.2.1.2-4.

**Table A.7.5.Y.2.1.2-1: Supported test configurations**

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

**Table A.7.5.Y.2.1.2-2: General test parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| L1-RSRP reporting period | slot | 160 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0, SSB1 | L1-RSRP measurements of SSB0 and SSB1. |
| Number of reported RS |  | 2 | L1-RSRP reporting of measurements on SSB0 and SSB1. |
| T1 | s | [0.2] |  |
| T2 | s | [2] |  |

**Table A.7.5.Y.2.1.2-3: NR Cell specific test parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Cell 1** |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| PL-RS Configuration for CSI-RS#0 |  | Resource #4 in TRS resource set 1 |
| PL-RS Configuration for CSI-RS#1 |  | Resource #4 in TRS resource set 2 |
| UL TCI State-0 Configuration |  | UL TCI.State.0 |
| UL TCI State-1 Configuration |  | UL TCI.State.1 |
| reportConfigType |  | ssb-Index-RSRP |
| reportConfigType |  | periodic |
| timeRestrictionForChannelMeasurements |  | configured |
| TRS Configuration |  | TRS.2.1 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRSNote 1 |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

**Table A.7.5.Y.2.1.2-4: OTA related test parameters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Cell 1** | | | | |
| **SSB0** | | **SSB1** | | |
| **T1** | **T2** | **T1** | **T2** | |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | | |
| AoA1 | | AoA2 | | |
| Assumption for UE beams Note 6 |  | Rough | | | | |
| NocNote 1 | dBm/15 kHz | -92.1 | | | | |
| NocNote 1 | dBm/SCS | -83.1 | | | | |
| Ês/Noc | dB | 1 | | -infinity | | 1 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.1 | | -infinity | | -82.1 |
| IoNote2 | dBm/95.04 MHz Note4 | -50.6 | | -54.1 | | -50.6 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation. | | | | | | |

A.7.5.Y.2.1.3 Test Requirements

During T2, the UE shall send L1-RSRP report with results for SSB0 and SSB1.

After receiving MAC-CE command in slot *n*, the UE shall:

* Continue transmitting using UL TCI state 0 up to and including slot *n* + THARQ/NR slot length +
* Start transmitting using UL TCI state 1, from slot *n* + (THARQ + 3ms + 100ms)/ NR slot length and onwards.

[The rate of correct events observed during repeated tests shall be at least [90]%]

#### A.7.5.Y.3 MAC-CE based active downlink TCI state switch

A.7.5.Y.3.1 NR PCell FR2 active downlink TCI state switch to cell with additional PCI for a known TCI state

A.7.5.Y.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.15.3. Supported test configuration is shown in Table A.7.5.Y.3.1.1-1.

Table A.7.5.Y.3.1.1-1: Supported test configurations

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

A.7.5.Y.3.1.2 Test Parameters

The test scenario comprises of one NR PCell (Cell 1) and one NR cell as the cell with additional PCI (Cell 2), as given in Table A.7.5.Y.3.1.2-1. Cell-specific parameters of NR PCell and the cell with additional PCI are specified in Table A.7.5.Y.3.1.2-2 below. The OTA related test parameters for FR2 are shown in Table A.7.5.Y.3.1.2-3.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

- UE is configured with 2 different TCI states for PCell, PDCCH TCI state 0 (QCL’d to TRS resource set 1, TCI state of which is QCLed to SSB0 of Cell1) and TCI state 1 (QCL’d to TRS resource set 3, TCI state of which is QCLed to SSB1 of Cell2), in Cell 1 before starting the test.

- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. Figure A.7.5.Y.3.1.2-1 and Figure A.7.5.Y.3.1.2-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL’d is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 of Cell 1 and SSB1 of Cell 2, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PCell on TCI state 0 till n+ THARQ +3 ms. The test equipment also verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after n+ THARQ +3 ms + (Tfirst-SSB + TSSB-proc).

Table A.7.5.Y.3.1.2-1: General test parameters for TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Cell with additional PCI |  | Cell 2 |  |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| T1 | s | 0.2 |  |
| T2 | s | 0.2 |  |

Table A.7.5.Y.3.1.2-2: NR Cell specific test parameters for TCI state switch to a cell with additional PCI

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 1 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3. 2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP. 5 |
| SSB Configuration |  | SSB.1 FR2 for SSB0 of Cell 1 and SSB1 of Cell 2 |
| SMTC Configuration |  | SMTC.1 |
| TCI State 0 |  | TCI.State.2 |
| TCI State 1 |  | TCI.State.5 |
| TRS Configuration |  | TRS.2.1 TDD  TRS 2.3 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table A.7.5.Y.3.1.2-3: OTA related test parameters for TCI state switch to a cell with additional PCI

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | | Cell 2 | |
|  |  | SSB0 | | SSB1 | |
|  |  | T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | |
|  |  | AoA1 | | AoA2 | |
| Assumption for UE beams Note 6 |  | Rough | | | |
| Ês | dBm/SCS | -80.6 | -80.6 | -Infinity | -80.6 |
| SS B\_RP Note 2 | dBm/ SCS | -80.6 | -80.6 | -Infinity | -80.6 |
| BB Note 7 | dB | 8.3 | 8.3 | -Infinity | 8.3 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.0 | -56.0 | - Infinity | -56.0 |
| Note 1: Void  Note 2: SS B\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Void  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.  Note 7: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | |



Figure A.7.5.Y.3.1.2-1: Time multiplexed downlink transmissions during T1



Figure A.7.5.Y.3.1.2-2: Time multiplexed downlink transmissions during T2

A.7.5.Y.3.1.3 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 of Cell 1 and SSB1 of Cell 2.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n+ THARQ +3

- be able to start receiving on TCI state 1 after n+ THARQ + (5 ms + Tfirst-SSB) / *NR slot length*

The rate of correct events observed during repeated tests shall be at least [90]%.

==========================End of change 11 =============================

==========================Start of change 12 =============================

## A.7.6 Measurement procedure

### A.7.6.3 L1-RSRP measurement for beam reporting

A.7.6.3.X1 Inter-cell SSB based L1-RSRP measurements on FR2 SCell when DRX is not used

A.7.6.3.X1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.13.4.1, with the testing configurations for NR serving cell in Table A.7.6.3.X1.1-1.

The AoA setup of FR2 cell for this test is Setup 3 as defined in clause A.3.15.

**Table A.7.6.3.X1.1-1: Applicable NR configurations for inter-cell SSB based L1-RSRP test in FR2**

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode  NR SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode  NR SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 3 | NR PCell 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 4 | NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode  NR SCell 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5 | NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode  NR SCell 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 6 | NR PCell 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR SCell 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

A.7.6.3.X1.2 Test parameters

There are two cells in the test, Cell 1 is the serving cell in CA, including a FR1 PCC and FR2 SCC. Cell 2 is a FR2 cell with different PCI from Cell 1. The test parameters for Cell 1 are given in Table A.7.6.3.X1.2-1. The test parameters for FR2 Cell (Cell 2) are given in Table A.7.6.3.X1.2-2 and Table A.7.6.3.X1.2-3.

SSB#0 and SSB#1 is transmitted on Cell 1 FR2 SCC and Cell 2.In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on SSB#0, and report measurement results periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. At the beginning of T2, SSB#1 starts transmission and the UE is configured for L1-RSRP measurement on SSB#1. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured in CSI-ReportConfigand *additionalPCIList* configured in *CSI-SSB-ResourceSet*.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD on Cell 1 in FR1 and perform L1-RSRP measurements on the SSB#0in FR2.

**Table A.7.6.3.X1.2-1: Cell specific test parameters for FR1 PCell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **Value** |
| SSB GSCN | 1~6 |  | freq1 |
| Duplex mode | 1,4 |  | FDD |
|  | 2,5 |  | TDD |
|  | 3,6 |  | TDD |
| TDD Configuration | 1,4 |  | N/A |
|  | 2,5 |  | TDDConf.1.1 |
|  | 3,6 |  | TDDConf.2.1 |
| BWchannel | 1,4 | MHz | 10: NRB,c = 52 |
|  | 2,5 |  | 10: NRB,c = 52 |
|  | 3,6 |  | 40: NRB,c = 106 |
| PDSCH Reference measurement channel | 1,4 |  | SR.1.1 FDD |
|  | 2,5 |  | SR.1.1 TDD |
|  | 3,6 |  | SR.2.1 TDD |
| RMSI CORESET Reference Channel | 1,4 |  | CR.1.1 FDD |
|  | 2,5 |  | CR.1.1 TDD |
|  | 3,6 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | 1,4 |  | CCR.1.1 FDD |
|  | 2,5 |  | CCR.1.1 TDD |
|  | 3,6 |  | CCR.2.1 TDD |
| SSB configuration | 1,4 |  | SSB.3 FR1 |
|  | 2,5 |  | SSB.3 FR1 |
|  | 3,6 |  | SSB.4 FR1 |
| OCNG Patterns | 1~6 |  | OP.1 |
| Initial BWP Configuration | 1~6 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~6 |  | DLBWP.1.1  ULBWP.1.1 |
| SMTC configuration | 1~6 |  | SMTC.1 |
| CSI-RS for tracking | 1,4 |  | TRS.1.1 FDD |
|  | 2,5 |  | TRS.1.1 TDD |
|  | 3,6 |  | TRS.1.2 TDD |
| DRX configuration | 1~6 |  | Off |
| SSB index assigned as RLM RS | 1~6 |  | 0,1 |
| SSB Index assigned as BFD RS (q0) | 1~6 |  | 0 |
| SSB Index assigned as CBD RS (q1) | 1~6 |  | 1 |
| EPRE ratio of PSS to SSS | 1~6 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |
| EPRE ratio of PDSCH to PDSCH DMRS |  |  |  |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  |  |
| Note2 | 1~6 | dBm/15 kHz | -104 |
|  | 1~6 | dB | 17 |
|  | 1~6 | dB | 17 |
| SS-RSRP Note3 | 1~6 | dBm/15 kHz | -87 |
| IoNote3 | 1,2,4,5 | dBm/  9.36MHz | -58.96 |
| 3,6 | dBm/  38.16MHz | -52.86 |
| Propagation condition | 1~6 |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for Noc to be fulfilled within BWoccupied.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess. | | | |

**Table A.7.6.3.X1.2-2: Cell specific test parameters for FR2 SCell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **Value** |
| SSB GSCN | 1~6 |  | Freq2 |
| Duplex mode | 1~6 |  | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 |
| BWchannel | 1~6 | MHz | 100: NRB,c = 66 |
| Data RBs allocated | 1~6 |  | 66 |
| PDSCH Reference measurement channel | 1,2,3 |  | SR.3.2 TDD |
| 4,5,6 | SR.3.3 TDD |
| RMSI CORESET Reference Channel | 1,2,3 |  | CR.3.1 TDD |
| 4,5,6 | CR.3.2 TDD |
| Dedicated CORESET Reference Channel | 1,2,3 |  | CCR.3.1 TDD |
| 4,5,6 | CCR.3.7 TDD |
| SSB configuration | 1,2,3 |  | SSB.1 FR2 |
|  | 4,5,6 | SSB.2 FR2 |
| OCNG Patterns | 1~6 |  | OP.1 |
| Initial BWP Configuration | 1~6 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~6 |  | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~6 |  | SMTC.1 |
| TRS Configuration | 1~6 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~6 |  | TCI.State.2 |
| DRX configuration | 1~6 |  | Off |
| reportConfigType | 1~6 |  | periodic |
| reportQuantity | 1~6 |  | ssb-Index-RSRP |
| Number of reported RS | 1~6 |  | 2 |
| SSB index associated to serving PCI | 1~6 |  | 0 |
| SSB index associated to a PCI different from serving cell | 1~6 |  | 1 |
| Timing offset between two SSBs associated to different PCI | 1~6 |  | <CP |
| L1-RSRP reporting period | 1~6 | slot | 320 |
| T1 | 1~6 | s | 5 |
| T2 | 1~6 | s | 2 |
| EPRE ratio of PSS to SSS | 1~6 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |
| EPRE ratio of PDSCH to PDSCH DMRS |  |  |  |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  |  |
| Propagation condition | 1~6 |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

**Table A.7.6.3.X1.2-2: SSB specific test parameters for FR2 SCell**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **SSB#0** | | **SSB#1** | |
|  |  |  | **T1** | **T2** | **T1** | **T2** |
| Angle of arrival configuration | 1~6 |  | Setup 3 according to A.3.15.3 | | | |
| AoA1 | | AoA2 | |
| Beam AssumptionNote 4 | 1~6 |  | Rough | | Rough | |
| Note2 | 1~6 | dBm/15kHz | -105 | | -105 | |
| Note2 | 1~3 | dBm/SSB SCS | -96 | | -96 | |
| 4~6 | -93 | | -93 | |
|  | 1~2 | dB | 0 | 0 | -Infinity | 9 |
| SSB\_RP Note3 | 1 | dBm/SSB SCS | -96 | -96 | -Infinity | -87 |
|  | 2 |  | -93 | -93 | -Infinity | -84 |
| Io Note3 | 1 | dBm/95.04MHz | -63.97 | -63.97 | -66.98 | -57.47 |
|  | 2 |  | -63.97 | -63.97 | -66.98 | -57.47 |
|  | 1~2 | dB | 0 | 0 | -Infinity | 9 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

A.7.6.3.X1.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2160 for UE supporting power class 1

- 1680 for UE supporting power class 2, 3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90%.

==========================End of change 12 =============================