**3GPP TSG- RAN4 Meeting # 111 *R4-2408548***

**Fukuoka, Japan, May 20th 2024 - May 24th 2024**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **4492** | **rev** | **-** | **Current version:** | **18.5.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | (NR\_MC\_enh-Perf) Correction to multi-carrier enhancement RRM test cases\_R18 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MC\_enh-Perf | | | | |  | ***Date:*** | | | 2024-05-13 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This CR is based on the endorsed draft CR R4-2404806, all changes with CM “Huawei” are already endorsed in RAN4#110bis, and the new changes in this CR are marked with CM “Huawei-RAN4#111”.  This CR is to solve following issues in Rel-18 Tx switching test cases.   1. Timing offset and TAG configurations need to be updated as explained in corresponding discussion paper R4-2408547. 2. the nominal RSRP level in A.6.5.7D.1/A.6.5.7D.4 needs to be aligned with A.6.5.7D.2/A.6.5.7D.3 as explained in corresponding discussion paper R4-2408547. 3. SRS configurations and AP CSI-RS configurations needs to be updated as explained in corresponding discussion paper R4-2408547. 4. Correlation Matrix and Antenna configuration are incorrect in A.6.5.7D.1, A.6.5.7D.2 and A.6.5.7D.4. It should be 1X2 low for Cells with 1T and 2X2 low for Cells with 2T. 5. SUL related description should be removed from the test purpose and environment of A.6.5.7D.2, A.6.5.7D.3 and A.6.5.7D.4 because SUL is not configured in these TCs. 6. “or four” should be removed from the test purpose and environment of A.6.5.7D.3 because only 3 cells are used in this TC. 7. SSB reference configuration is missing for Cell 3 in A.6.5.7D.3. SSB.2 FR1 should be used. 8. It’s incorrect to check DL interruptions on Cell 2, Cell 3 and Cell 4 at the same time in A.6.5.7D.4 because this is a 1T-1T to 1T-1T Tx switching test case. It should be DL interruptions on Cell 1 and Cell 2 are checked together, and DL interruptions on Cell 3 and Cell 4 are checked together, just like A.6.5.7D.2. 9. Brackets to be removed. 10. Typos to be fixed. 11. Editorial changes to improve readiability. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Issues mentioned above are fixed. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | DL interruptions at Tx switching across three/ four uplink bands are not correct. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | A.6.5.7D.1, A.6.5.7D.2, A.6.5.7D.3, A.6.5.7D.4 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

<Start of Change 1>

### A.6.5.7D DL interruptions at UE switching across three or four uplink bands

#### A.6.5.7D.1 DL interruptions at switching across three uplink bands in TDD-TDD CA for single TAG

##### A.6.5.7D.1.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching across three uplink bands for single TAG defined in clause 8.2.2.2.10D. The test case is applicable for an inter-band TDD-TDD CA configuration when the capability *BandCombination-UplinkTxSwitch-v1800* is present, where NR UL carrier 1 in band A is capable of one transmit antenna connector, NR UL carrier 2 in band B is capable of one transmit antenna connector and NR UL carrier 3 in band C is capable of two transmit antenna connectors. NR UL carrier 1, carrier 2 and carrier 3 in band A, band B and band C, respectively, are different bands with different carrier frequencies. All cells belong to the same TAG.

There are three cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where cell 1 with 1TX is on band A, cell 2 with 1TX is on band B, and cell 3 with 2TX is on band C. The test parameters for the three cells are given in Table A.6.5.7D.1.1-1, Table A.6.5.7D.1.1-2 and Table A.6.5.7D.1.1-3 below. TX switching is from band A and band B to band C.

For NR TDD PCell (Cell 1) and NR TDD SCell (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6dB on the following symbol in the 1st special slot of every radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #4 if UE capability uplink Tx switching period is 210us or

- symbol #5 if UE capability uplink Tx switching period is 140us or

- symbol #8 if UE capability uplink Tx switching period is 35us.

For NR TDD SCell (Cell 3), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol on the 2nd special slot of every radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #4 if UE capability uplink Tx switching period is 210us or

- symbol #5 if UE capability uplink Tx switching period is 140us or

- symbol #8 if UE capability uplink Tx switching period is 35us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |

Table A.6.5.7D.1.1-2: General test parameters for DL interruptions at switching across three uplink bands in TDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| RF Channel Number |  | Config 1 | 1, 2, 3 | Three radio channels are used for this test. |
| Active cell |  | Config 1 | Cell 1: FR1 PCell  Cell 2: FR1 SCell  Cell 3: FR1 SCell | FR1 PCell on RF channel number 1  FR1 SCell on RF channel number 2  FR1 SCell on RF channel number 3 |
| CP length |  | Config 1 | Normal |  |
| DRX |  | Config 1 | OFF |  |
| Measurement gap pattern Id |  | Config 1 | OFF |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| CSI-RS configuration for L1-RSRP reporting |  | Config 1 | Cell 1: CSI-RS.2.5 TDD  Cell 2: CSI-RS.2.5 TDD  Cell 3: CSI-RS.2.5 TDD |  |
| T1 | s | Config 1 | 5 |  |

Table A.6.5.7D.1.1-3: Cell specific test parameters for DL interruptions at switching across three uplink bands in TDD-TDD CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell1 | Cell2 | Cell3 |
| Frequency Range | |  | FR1 | FR1 | FR1 |
| Duplex mode | Config 1 |  | TDD | TDD | TDD |
| TDD configuration | Config 1 |  | TDDConf.2.1 except that  S=’11DL: 1GP :2UL’;  *nrofDownlinkSymbols: 11*  *nrofUplinkSymbols: 2* | TDDConf.2.1 except that  S=’11DL: 1GP :2UL’;  *nrofDownlinkSymbols: 11*  *nrofUplinkSymbols: 2* | TDDConf.2.2 |
| BWchannel | Config 1 | MHz | 40: NRB,c = 106 | 40: NRB,c = 106 | 40: NRB,c = 106 |
| Initial BWP Configuration | Config 1 |  | DLBWP.0.1 | DLBWP.0.1 | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1 |  | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 |
| UL dedicated BWP configuration | Config 1 |  | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 |
| SRS configuration | Config 1 |  | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,5 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,5 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,3 |
| PDSCH Reference measurement channel | Config 1 |  | SR.2.1 TDD | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET parameters | Config 1 |  | CR.2.1 TDD | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1 |  | CCR.2.1 TDD | CCR.2.1 TDD | CCR.2.1 TDD |
| OCNG Patterns | |  | OP.1 | OP.1 | OP.1 |
| SMTC Configuration | |  | SMTC.1 | SMTC.1 | SMTC.1 |
| SSB Configuration | Config 1 |  | SSB.2 FR1 | SSB.2 FR1 | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 2x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 | 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) | |  |  |  |  |
| NocNote 2 | | dBm/15 kHz | -104 | -104 | -104 |
| SS-RSRP Note 3 | | dBm/SCS | -87 | -87 | -87 |
| Ês/Iot | | dB | 14 | 14 | 14 |
| Ês/Noc | | dB | 14 | 14 | 14 |
| NocNote 2 | Config 1 | dBm/SCS | -101 | -101 | -101 |
| IoNote3 | Config 1 | dBm/  38.16MHz | -55.79 | -55.79 | -55.79 |
| Time offset to Cell1 Note 5 | | μs | - | 0 | 0 |
| Propagation Condition | |  | AWGN | AWGN | 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 modelled as AWGN of appropriate power for Noc 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.  Note 4: Void  Note 5: Receive time difference between slot boundaries of signals received from the three cells at the UE antenna connector including time alignment error between the three cells. | | | | | |

##### A.6.5.7D.1.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

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

#### A.6.5.7D.2 DL interruptions at switching across four uplink bands in FDD-TDD CA for single TAG

##### A.6.5.7D.2.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching across four uplink bands for single TAG defined in clause 8.2.2.2.10D. The test case is applicable an NR inter-band CA configuration when the capability *BandCombination-UplinkTxSwitch-v1800* is present, where NR UL carrier 1 in band A, NR UL carrier 2 in band B, NR UL carrier 3 in band C and NR UL carrier 4 in band D are capable of one transmit antenna connector respectively. All cells belong to the same TAG.

There are four cells: FR1 FDD PCell (Cell 1), FR1 FDD SCell (Cell 2), FR1 TDD SCell (Cell 3) and FR1 TDD SCell (Cell 4) where cell 1 in band A is with 1TX, cell 2 in band B is with 1TX, cell 3 in band C is with 1TX and cell 4 in band D is with 1TX. The test parameters for the four cells are given in Table A.6.5.7D.2.1-1, Table A.6.5.7D.2.1-2 and Table A.6.5.7D.2.1-3 below. TX switching is from band A and band B to band C and band D.

For NR FDD carrier Cell 1 and NR FDD carrier Cell2, aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6dB on the following symbol in the slot overlapping with the 1st special slot of every radio frame of the NR TDD carrier (Cell 3):

- symbol#12 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #8 if UE indicated uplink Tx switching period is 210us or

- symbol #9 if UE indicated uplink Tx switching period is 140us or

- symbol #10 if UE indicated uplink Tx switching period is 35us.

For NR TDD Cell 3 and NR TDD Cell 4, aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol in the 2nd special slot of every radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #4 if UE indicated uplink Tx switching period is 210us or

- symbol #5 if UE indicated uplink Tx switching period is 140us or

- symbol #8 if UE indicated uplink Tx switching period is 35us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.2.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode  NR Cell 2: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode  NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR Cell 4: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |

Table A.6.5.7D.2.1-2: General test parameters for DL interruptions at switching across four uplink bands in FDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| RF Channel Number |  | Config 1 | 1, 2, 3, 4 | Four radio channels are used for this test. |
| Active cell |  | Config 1 | Cell 1: FR1 PCell  Cell 2: FR1 SCell  Cell 3: FR1 SCell  Cell 4: FR1 SCell | Cell 1: FR1 PCell on RF channel number 1 in band A  Cell 2: FR1 SCell on RF channel number 2 in band B  Cell 3: FR1 SCell on RF channel number 3 in band C  Cell 4: FR1 SCell on RF channel number 4 in band D |
| CP length |  | Config 1 | Normal |  |
| DRX |  | Config 1 | OFF |  |
| Measurement gap pattern Id |  | Config 1 | OFF |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| CSI-RS configuration for L1-RSRP reporting |  | Config 1 | Cell 1: CSI-RS.1.5 FDD  Cell 2: CSI-RS.1.5 FDD  Cell 3: CSI-RS.2.5 TDD  Cell 4: CSI-RS.2.5 TDD |  |
| T1 | s | Config 1 | 5 |  |

Table A.6.5.7D.2.1-3: Cell specific test parameters for DL interruptions at switching across four uplink bands in FDD-TDD CA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell1 | Cell 2 | Cell3 | Cell4 |
| Frequency Range | | |  | FR1 | FR1 | FR1 | FR1 |
| Duplex mode | | Config 1 |  | FDD | FDD | TDD | TDD |
| TDD configuration | | Config 1 |  | N/A | N/A | TDDConf.2.1 except that:  S=’11DL: 1GP:2UL’;  *nrofDownlinkSymbols: 11*  *nrofUplinkSymbols: 2* | TDDConf.2.1 except that:  S=’11DL: 1GP:2UL’;  *nrofDownlinkSymbols: 11*  *nrofUplinkSymbols: 2* |
| BWchannel | | Config 1 | MHz | 10: NRB,c = 52 | 10: NRB,c = 52 | 40: NRB,c = 106 | 40: NRB,c = 106 |
| Initial BWP Configuration | | Config 1 |  | DLBWP.0.1 | DLBWP.0.1 | DLBWP.0.1 | DLBWP.0.1 |
| DL dedicated BWP configuration | | Config 1 |  | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 |
| UL dedicated BWP configuration | | Config 1 |  | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 |
| SRS configuration | | Config 1 |  | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl10,6 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl10,6 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,3 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,3 |
| PDSCH Reference measurement channel | | Config 1 |  | SR.1.1 FDD | SR.1.1 FDD | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET parameters | | Config 1 |  | CR.1.1 FDD | CR.1.1 FDD | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET parameters | | Config 1 |  | CCR.1.1 FDD | CCR.1.1 FDD | CCR.2.1 TDD | CCR.2.1 TDD |
| OCNG Patterns | | |  | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC Configuration | | |  | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 |
| SSB Configuration | Config 1 | |  | SSB.1 FR1 | SSB.1 FR1 | SSB.2 FR1 | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | | |  | 1x2 Low | 1x2 Low | 1x2 Low | 1x2 Low |
| EPRE ratio of PSS to SSS | | | dB | 0 | 0 | 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) | | |  |  |  |  |  |
| NocNote 2 | | | dBm/15 kHz | -104 | -104 | -104 | -104 |
| SS-RSRP Note 3 | | | dBm/SCS | -87 | -87 | -87 | -87 |
| Ês/Iot | | | dB | 17 | 17 | 14 | 14 |
| Ês/Noc | | | dB | 17 | 17 | 14 | 14 |
| NocNote 2 | Config 1 | | dBm/SCS | -104 | -104 | -101 | -101 |
| IoNote3 | Config 1 | | dBm/9.36 MHz | -58.96 | -58.96 | - | - |
|  |  | | dBm/  38.16MHz | - | - | -55.79 | -55.79 |
| Time offset to Cell1 Note 5 | | | μs | - | 0 | 0 | 0 |
| Propagation Condition | | |  | AWGN | AWGN | AWGN | 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 modelled as AWGN of appropriate power for Noc 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.  Note 4: Void  Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells. | | | | | | | |

##### A.6.5.7D.2.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

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

#### A.6.5.7D.3 DL interruptions at switching across three uplink bands in FDD-TDD CA for two TAGs

##### A.6.5.7D.3.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching across 3 bands with one or two transmit antenna connectors defined in clause 8.2.2.2.10D for two TAGs. The test case is applicable for an NR inter-band CA configuration when the capability [*BandCombination-UplinkTxSwitch-v1800*] is present, where in NR inter-band CA configuration, the number of NR uplink bands with different carrier frequencies is three. NR UL carrier(s) in each of the three uplink bands are capable of one or two transmit antenna connector(s), according to the UE capability. Cell 1 and Cell 2 belong to one TAG, and Cell 3 belongs to the other TAG.

There are three cells: FR1 FDD PCell (Cell 1), FR1 FDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where cell 1 with 1TX is on band A, cell 2 with 1TX is on band B, and cell 3 with 2TX is on band C. The test parameters for the three cells are given in Table A.6.5.7D.3.1-1, Table A.6.5.7D.3.1-2 and Table A.6.5.7D.3.1-3 below. TX switching is from band A and band B to band C.

For NR FDD carrier Cell 1 and NR FDD carrier Cell2, aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6dB on the following symbol in slot overlapping with the 1st special slot of every radio frame of the NR TDD carrier (Cell 3):

- symbol#12 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #8 if UE indicated uplink Tx switching periodis 210us or

- symbol #9 if UE indicated uplink Tx switching period is 140us or

- symbol #10 indicated uplink Tx switching periodis 35us.

For NR TDD carrier (Cell 3), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol in the 2nd special slot of every radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #3 if UE indicated uplink Tx switching period is 210us or

- symbol #5 if UE indicated uplink Tx switching period is 140us or

- symbol #8 if UE indicated uplink Tx switching period is 35us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.3.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode  NR Cell 2: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode  NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |

Table A.6.5.7D.3.1-2: General test parameters for DL interruptions at switching across 3 bands with one or two transmit antenna connectors in FDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test configuration** | **Value** | **Comment** |
| RF Channel Number |  | Config 1 | 1, 2, 3 | Three radio channels are used for this test. |
| Active cell |  | Config 1 | Cell 1: FR1 PCell  Cell 2: FR1 SCell  Cell 3: FR1 SCell | FR1 PCell on RF channel number 1  FR1 SCell on RF channel number 2  FR1 SCell on RF channel number 3 |
| CP length |  | Config 1 | Normal |  |
| DRX |  | Config 1 | OFF |  |
| Measurement gap pattern Id |  | Config 1 | OFF |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| CSI-RS configuration for L1-RSRP reporting |  | Config 1 | Cell 1: CSI-RS.1.5 FDD  Cell 2: CSI-RS.1.5 FDD  Cell 3: CSI-RS.2.5 TDD |  |
| T1 | s | Config 1 | 5 |  |

Table A.6.5.7D.3.1-3: Cell specific test parameters for DL interruptions at switching across 3 bands with one or two transmit antenna connectors in FDD-TDD CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell1 | Cell2 | Cell3 |
| Frequency Range | |  | FR1 | FR1 | FR1 |
| Duplex mode | Config 1 |  | FDD | FDD | TDD |
| TDD configuration | Config 1 |  | N/A | N/A | TDDConf.2.1 except that:  S=’11DL: 1GP:2UL’;  *nrofDownlinkSymbols: 11*  *nrofUplinkSymbols: 2* |
| BWchannel | Config 1 | MHz | 10: NRB,c = 52 | 10: NRB,c = 52 | 40: NRB,c = 106 |
| Initial BWP Configuration | Config 1 |  | DLBWP.0.1 | DLBWP.0.1 | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1 |  | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 |
| UL dedicated BWP configuration | Config 1 |  | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 |
| SRS configuration | Config 1 |  | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl10,6 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl10,6 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,3 |
| PDSCH Reference measurement channel | Config 1 |  | SR.1.1 FDD | SR.1.1 FDD | SR.2.1 TDD |
| RMSI CORESET parameters | Config 1 |  | CR.1.1 FDD | CR.1.1 FDD | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1 |  | CCR.1.1 FDD | CCR.1.1 FDD | CCR.2.1 TDD |
| OCNG Patterns | |  | OP.1 | OP.1 | OP.1 |
| SMTC Configuration | |  | SMTC.1 | SMTC.1 | SMTC.1 |
| SSB Configuration | Config 1 |  | SSB.1 FR1 | SSB.1 FR1 | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 2x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 | 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) | |  |  |  |  |
| NocNote 2 | | dBm/15 kHz | -104 | -104 | -104 |
| SS-RSRP Note 3 | | dBm/SCS | -87 | -87 | -87 |
| Ês/Iot | | dB | 17 | 17 | 14 |
| Ês/Noc | | dB | 17 | 17 | 14 |
| NocNote 2 | Config 1 | dBm/SCS | -104 | -104 | -101 |
| IoNote3 | Config 1 | dBm/9.36 MHz | -58.96 | -58.96 | - |
|  |  | dBm/  38.16MHz | - | - | -55.79 |
| Time offset to Cell1 Note 5 | | μs | - | 0 | 9 |
| Propagation Condition | |  | AWGN | AWGN | 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 modelled as AWGN of appropriate power for Noc 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.  Note 4: Void  Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells. | | | | | |

##### A.6.5.7D.3.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D for two TAGs case and provided in Table 8.2.2.2.10D-2.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

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

#### A.6.5.7D.4 DL interruptions at switching across four uplink bands in TDD-TDD CA for two TAGs

##### A.6.5.7D.4.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic across four bands with one or two transmit antenna connectors defined in clause 8.2.2.2.10D for two TAGs. The test cases are applicable for an NR inter-band CA configuration when the capability *BandCombination-UplinkTxSwitch-v1800* is present, where in NR inter-band CA configuration, the number of NR uplink bands with different carrier frequencies is four. NR UL carrier(s) in each of the four uplink bands are capable of one transmit antenna connector(s), according to the UE capability. Cell 1 and Cell 2 belong to one TAG, and Cell 3 and Cell 4 belong to the other TAG.

There are four cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2), FR1 TDD SCell (Cell 3) and FR1 TDD SCell (Cell 4) where cell 1 in band A is with 1TX, cell 2 in band B is with 1TX, cell 3 in band C is with 1TX and cell 4 in band D is with 1TX. The test parameters for the four cells are given in Table A.6.5.7D.4.1-1, Table A.6.5.7D.4.1-2 and Table A.6.5.7D.4.1-3 below. TX switching is from band A and band B to band C and band D.

For NR TDD PCell (Cell 1) and NR TDD SCell (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting [6dB] on the following symbol in the 1st special slot of every radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #3 if UE capability uplink Tx switching periodis 210us or

- symbol #5 if UE capability uplink Tx switching periodis 140us or

- symbol #8 if UE capability uplink Tx switching periodis 35us.

For NR TDD SCell (Cell 3) and NR TDD SCell (Cell 4), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting [6dB] on the following symbol on the 2nd special slot of every radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;

- otherwise,

- symbol #3 if UE capability uplink Tx switching period is 210us or

- symbol #5 if UE capability uplink Tx switching periodis 140us or

- symbol #8 if UE capability uplink Tx switching period is 35us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR Cell 4: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |

Table A.6.5.7D.4.1-2: General test parameters for DL interruptions at switching across 4 bands with one or two transmit antenna connectors in TDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| RF Channel Number |  | Config 1 | 1, 2, 3, 4 | Four radio channels are used for this test. |
| Active cell |  | Config 1 | Cell 1: FR1 PCell  Cell 2: FR1 SCell  Cell 3: FR1 SCell  Cell 4: FR1 SCell | FR1 PCell on RF channel number 1  FR1 SCell on RF channel number 2  FR1 SCell on RF channel number 3  FR1 SCell on RF channel number 4 |
| CP length |  | Config 1 | Normal |  |
| DRX |  | Config 1 | OFF |  |
| Measurement gap pattern Id |  | Config 1 | OFF |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| CSI-RS configuration for L1-RSRP reporting |  | Config 1 | Cell 1: CSI-RS.2.5 TDD  Cell 2: CSI-RS.2.5 TDD  Cell 3: CSI-RS.2.5 TDD  Cell 4: CSI-RS.2.5 TDD |  |
| T1 | S | Config 1 | 5 |  |

Table A.6.5.7D.7.1-3: Cell specific test parameters for DL interruptions at switching across 4 bands with one or two transmit antenna connectors in TDD-TDD CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell1 | Cell2 | Cell3 | Cell4 |
| Frequency Range | |  | FR1 | FR1 | FR1 | FR1 |
| Duplex mode | Config 1 |  | TDD | TDD | TDD | TDD |
| TDD configuration | Config 1 |  | TDDConf.2.1 except that  S=’1 1DL: :2UL’;  *nrofDownlinkSymbols: 11*  *nrofUplinkSymbols: 2* | TDDConf.2.1 except that  S=’1 1DL: :2UL’;  *nrofDownlinkSymbols: 11*  *nrofUplinkSymbols: 2* | TDDConf.2.2 | TDDConf.2.2 |
| BWchannel | Config 1 | MHz | 40: NRB,c = 106 | 40: NRB,c = 106 | 40: NRB,c = 106 | 40: NRB,c = 106 |
| Initial BWP Configuration | Config 1 |  | DLBWP.0.1 | DLBWP.0.1 | DLBWP.0.1 | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1 |  | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 |
| UL dedicated BWP configuration | Config 1 |  | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 |
| SRS configuration | Config 1 |  | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,5 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,5 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,3 | SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2  periodicityAndOffset-p: sl20,3 |
| PDSCH Reference measurement channel | Config 1 |  | SR.2.1 TDD | SR.2.1 TDD | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET parameters | Config 1 |  | CR.2.1 TDD | CR.2.1 TDD | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1 |  | CCR.2.1 TDD | CCR.2.1 TDD | CCR.2.1 TDD | CCR.2.1 TDD |
| OCNG Patterns | |  | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC Configuration | |  | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 |
| SSB Configuration | Config 1 |  | SSB.2 FR1 | SSB.2 FR1 | SSB.2 FR1 | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 | 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) | |  |  |  |  |  |
| NocNote 2 | | dBm/15 kHz | -104 | -104 | -104 | -104 |
| SS-RSRP Note 3 | | dBm/SCS | -87 | -87 | -87 | -87 |
| Ês/Iot | | dB | 14 | 14 | 14 | 14 |
| Ês/Noc | | dB | 14 | 14 | 14 | 14 |
| NocNote 2 | Config 1 | dBm/SCS | -101 | -101 | -101 | -101 |
| IoNote3 | Config 1 | dBm/  38.16MHz | -55.79 | -55.79 | -55.79 | -55.79 |
| Time offset to Cell1 Note 5 | | μs | - | 0 | 9 | 9 |
| Propagation Condition | |  | AWGN | AWGN | AWGN | 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 modelled as AWGN of appropriate power for Noc 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.  Note 4: Void  Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells. | | | | | | |

##### A.6.5.7D.7.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D for two TAGs case and provided in Table 8.2.2.2.10D-2.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

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

<End of Change 1>