**3GPP TSG-RAN WG4 Meeting #94-e**

**Electronic meeting, 24 February – 6 March, 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **36.101** | **CR** | **5598** | **rev** | 1 | **Current version:** | **16.4.0** |  |
|  |
| *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:***  | Finalization of CA PDSCH demodulation requirements with HST-SFN |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | LTE\_high\_speed\_enh2-Perf |  | ***Date:*** | 2020-03-04 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Several requirements of CA PDSCH demodulation with HST-SFN scenario are in [] |
|  |  |
| ***Summary of change:*** | Removal of []Co |
|  |  |
| ***Consequences if not approved:*** | CA PDSCH demodulation requirements with HST-SNT is not complete. |
|  |  |
| ***Clauses affected:*** | 8.2.1.9.1, 8.2.2.9.1, 8.2.3.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS36.521-1 ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

----------------------------------------------------- Beginning of Change ------------------------------------------------------------

#### 8.2.1.9 HST-SFN performance

##### 8.2.1.9.1 Minimum Requirement

The purpose of this test is to verify UE performance in the HST-SFN scenario defined in B.3A when *highSpeedEnhancedDemodulationFlag*[7] is received.

For single carrier, the requirements are specified in Table 8.2.1.9.1-2, with the addition of the parameters in Table 8.2.1.9.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CC, the requirements are specified in Table 8.2.1.9.1-5, based on single carrier requirement specified in Table 8.2.1.9.1-4, with the addition of the parameters in Table 8.2.1.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.1.9.1-6, based on single carrier requirement specified in Table 8.2.1.9.1-4, with the addition of the parameters in Table 8.2.1.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are specified in Table 8.2.1.9.1-7, based on single carrier requirement specified in Table 8.2.1.9.1-4, with the addition of the parameters in Table 8.2.1.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are specified in Table 8.2.1.9.1-8, based on single carrier requirement specified in Table 8.2.1.9.1-4, with the addition of the parameters in Table 8.2.1.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.9.1-1: Test Parameters for UE performance in HST-SFN scenario (FRC)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (NOTE 1) |
| σ | dB | 0 |
| at antenna port | dBm/15kHz | -98 |
| PDSCH transmission mode |  | 3 |
| NOTE 1: . |

Table 8.2.1.9.1-2: Minimum performance UE in HST-SFN scenario (FRC)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width  | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | UE Category |
| Fraction of MaximumThroughput (%) | SNR (dB) |
| 1 | 10 MHz | R.87 FDD | OP.1 FDD | HST-SFN | 2x2 | 70 | 13.3 | ≥1 |
| NOTE 1: The requirement defined is based on the normalized channel model, i.e., the power of each tap is normalized to the instantaneous total received power from four taps. |

Table 8.2.1.9.1-3: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (NOTE 1) |
| σ | dB | 0 |
| at antenna port | dBm/15kHz | -98 |
| PDSCH transmission mode |  | 3 |
| NOTE 1: .NOTE 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK for Tests in Table 8.2.1.3.1-4, PUCCH format 3 is used to feedback ACK/NACK for Tests in Table 8.2.1.3.1-6.NOTE 3: The same PDSCH transmission mode is applied to each component carrier. |

Table 8.2.1.9.1-4: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condition | Correlation matrix and antenna config. | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 MHz | R.87-2 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 13.9 |
| 10 MHz | R.87 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 13.3 |
| 15 MHz | R.87-3 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 13.9 |
| 20 MHz | R.87-4 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 14.1 |

Table 8.2.1.9.1-5: Minimum performance Large Delay CDD (FRC) for CA with 2DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 2x10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 2 | 2x20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 3 | 2x5MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 4 | 10MHz+5MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 5 | 15MHz+5MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |

Table 8.2.1.9.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 3x20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 2 | 20MHz+20MHz+15MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 3 | 20MHz+20MHz+10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 4 | 20MHz+15MHz+15MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 5 | 20MHz+15MHz+10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 6 | 20MHz+10MHz+10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 7 | 15MHz+15MHz+10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 8 | 20MHz+10MHz+5MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 9 | 20MHz+15MHz+5MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 10 | 10MHz+10MHz+5MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 11 | 5MHz+5MHz+20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 12 | 3x10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| 13 | 5MHz+5MHz+10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥5 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3 |

Table 8.2.1.9.1-7: Minimum performance (FRC) based on single carrier performance for CA with 4 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 4x20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 2 | 10MHz+20MHz+20MHz+20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 3 | 10MHz+10MHz+20MHz+20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 4 | 5MHz+10MHz+20MHz+20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 5 | 5MHz+10MHz+10MHz+20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 6 | 15+3x20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 7 | 2x15+2x20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 8 | 10+15+2x20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 9 | 3x10+20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 10 | 2x5+2x20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 11 | 2x5+10+20MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| 12 | 4x10MHz | As specified in Table 8.2.1.9.1-4 per CC | ≥8 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3 |

Table 8.2.1.9.1-8: Minimum performance (FRC) based on single carrier performance for CA with 5 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 5x20MHz | As specified in Table 8.2.1.9.1-4 per CC | 8, ≥11 |
| 2 | 15MHz+4x20MHz | As specified in Table 8.2.1.9.1-4 per CC | 8, ≥11 |
| 3 | 10MHz+4x20MHz | As specified in Table 8.2.1.9.1-4 per CC | 8, ≥11 |
| 4 | 2x10MHz+3x20MHz | As specified in Table 8.2.1.9.1-4 per CC | 8, ≥11 |
| 5 | 5MHz+10MHz+3x20MHz | As specified in Table 8.2.1.9.1-4 per CC | 8, ≥11 |
| 6 | 3x10MHz+2x20MHz | As specified in Table 8.2.1.9.1-4 per CC | 8, ≥11 |
| 7 | 4x10MHz+20MHz | As specified in Table 8.2.1.9.1-4 per CC | 8, ≥11 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3 |

------------------------------------------------- Unchanged sections omitted --------------------------------------------------------

#### 8.2.2.9 HST-SFN performance

##### 8.2.2.9.1 Minimum Requirement

The purpose of this test is to verify UE performance in the HST-SFN scenario defined in B.3A when *highSpeedEnhancedDemodulationFlag*[7] is received.

For single carrier, the requirements are specified in Table 8.2.2.9.1-2, with the addition of the parameters in Table 8.2.2.9.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.2.9.1-5, based on single carrier requirement specified in Table 8.2.2.9.1-4, with the addition of the parameters in Table 8.2.2.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.9.1-6, based on single carrier requirement specified in Table 8.2.2.9.1-4, with the addition of the parameters in Table 8.2.2.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are specified in Table 8.2.2.9.1-7, based on single carrier requirement specified in Table 8.2.2.9.1-4, with the addition of the parameters in Table 8.2.2.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are specified in Table 8.2.2.9.1-8, based on single carrier requirement specified in Table 8.2.2.9.1-4, with the addition of the parameters in Table 8.2.2.9.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.9.1-1: Test Parameters for UE performance in HST-SFN scenario (FRC)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (NOTE 1) |
| σ | dB | 0 |
| at antenna port | dBm/15kHz | -98 |
| ACK/NACK feedback mode |  | Multiplexing |
| PDSCH transmission mode |  | 3 |
| NOTE 1: . |

Table 8.2.2.9.1-2: Minimum performance UE in HST-SFN scenario (FRC)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width  | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | UE Category |
| Fraction of MaximumThroughput (%) | SNR (dB) |
| 1 | 10 MHz | R.87 TDD | OP.1 TDD | HST-SFN | 2x2 | 70 | 13.2 | ≥1 |
| NOTE 1: Test case applicability is defined in 8.1.2.1.NOTE 2: The requirement defined is based on the normalized channel model, i.e., the power of each tap is normalized to the instantaneous total received power from four taps. |

Table 8.2.2.9.1-3: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | dBm/15kHz | -98 |
| ACK/NACK feedback mode |  | PUCCH format 1b with channel selection for Tests in Table 8.2.2.3.1-4; PUCCH format 3 for Tests in Table 8.2.2.3.1-7 |
| PDSCH transmission mode |  | 3 |
| NOTE 1: NOTE 2: VoidNOTE 3: The same PDSCH transmission mode is applied to each component carrier. |

Table 8.2.2.9.1-4: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 MHz | R.87-2 TDD | OP.1 TDD  | HST-SFN | 2x2 Low | 70 | 13.1 |
| 10 MHz | R.87 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.2 |
| 15 MHz | R.87-3 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.4 |
| 20 MHz | R.87-4 TDD | OP. 1 TDD | HST-SFN | 2x2 Low | 70 | 13.6 |

Table 8.2.2.9.1-5: Minimum performance (FRC) based on single carrier performance for CA with 2 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
|
| 1 | 2x20 MHz | As specified in Table 8.2.2.9.1-4 per CC | ≥5 |
| 2 | 20 MHz + 15 MHz | As specified in Table 8.2.2.9.1-4 per CC | ≥5 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3 |

Table 8.2.2.9.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
|
| 1 | 3x20 MHz | As specified in Table 8.2.2.9.1-4 per CC | ≥5 |
| 2 | 20 MHz + 20 MHz + 15 MHz | As specified in Table 8.2.2.9.1-4 per CC | ≥5 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3 |

Table 8.2.2.9.1-7: Minimum performance (FRC) based on single carrier performance for CA with 4 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
|
| 1 | 4x20 MHz | As specified in Table 8.2.2.9.1-4 per CC | ≥8 |
| 2 | 20 MHz + 20 MHz + 20 MHz + 15 MHz | As specified in Table 8.2.2.9.1-4 per CC | ≥8 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3 |

Table 8.2.2.9.1-8: Minimum performance (FRC) based on single carrier performance for CA with 5 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
|
| 1 | 5x20 MHz | As specified in Table 8.2.2.9.1-4 per CC | 8, ≥11 |
| 2 | 15 MHz + 4x20 MHz | As specified in Table 8.2.2.9.1-4 per CC | 8, ≥11 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3 |

------------------------------------------------- Unchanged sections omitted --------------------------------------------------------

#### 8.2.3.5 HST-SFN performance

##### 8.2.3.5.0 General

The purpose of this test is to verify UE performance in the HST-SFN scenario defined in B.3A when *highSpeedEnhancedDemodulationFlag*[7] is received.

##### 8.2.3.5.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.5.1-4 based on single carrier requirement specified in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3, with the addition of the parameters in Table 8.2.3.5.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.5.1-5 based on single carrier requirement specified in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3, with the addition of the parameters in Table 8.2.3.5.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.5.1-6 based on single carrier requirement specified in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3, with the addition of the parameters in Table 8.2.3.5.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.5.1-7 based on single carrier requirement specified in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3, with the addition of the parameters in Table 8.2.3.5.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.5.1-1: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | dBm/15kHz | -98 |
| PDSCH transmission mode |  | 3 |
| NOTE 1: .NOTE 2: The same PDSCH transmission mode is applied to each component carrier. |

Table 8.2.3.5.1-2: Single carrier performance for multiple CA configurations for FDD PCell and SCell (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condition | Correlation matrix and antenna config. | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 MHz | R.87-2 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 13.9 |
| 10 MHz | R.87 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 13.3 |
| 15 MHz | R.87-3 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 13.9 |
| 20 MHz | R.87-4 FDD | OP. 1 FDD | HST-SFN | 2x2 Low | 70 | 14.1 |

Table 8.2.3.5.1-3: Single carrier performance for multiple CA configurations for TDD SCell (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 MHz | R.87-2 TDD | OP.1 TDD  | HST-SFN | 2x2 Low | 70 | 13.1 |
| 10 MHz | R.87 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.2 |
| 15 MHz | R.87-3 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.4 |
| 20 MHz | R.87-4 TDD | OP. 1 TDD | HST-SFN | 2x2 Low | 70 | 13.6 |

Table 8.2.3.5.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B |

Table 8.2.3.5.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| **Test number** | **Aggregated Bandwidth (MHz)** | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 4 | 3x20 | 2x20 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 5 | 20+20+15 | 20+15 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 6 | 20+20+10 | 20+10 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 7 | 20+10+10 | 2x10 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 8 | 10+15+20 | 10 | 15+20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| 9 | 10+15+20 | 10+15 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥5 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B. |

Table 8.2.3.5.1-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 4x20 | 20 | 3x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 2 | 4x20 | 2×20 | 2×20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 3 | 3x20+15 | 20+15 | 2×20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 4 | 2×15+2x20 | 2×15 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 5 | 3x20+15 | 2×20+15 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 6 | 2×15+2x20 | 2x15+20 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 7 | 3x20+10 | 2x20+10 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 8 | 4x20 | 3x20 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 9 | 10+3x20 | 10 | 3x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 10 | 2x10+2x20 | 2x10 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 11 | 2x10+20+15 | 2x10 | 20+15 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 12 | 10+3x20 | 10+20 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 13 | 10+15+2x20 | 10+15 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| 14 | 10+15+2x20 | 10+15+20 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | ≥8 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B. |

Table 8.2.3.5.1-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 15+4×20 | 15+2×20 | 2×20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 2 | 2×15+3×20 | 2×15+20 | 2×20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 3 | 4x20+20 | 4x20 | 20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 4 | 3x20+2x20 | 3x20 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 5 | 2x20+3x20 | 2x20 | 3X20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 6 | 20+4x20 | 20 | 4x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 7 | 10+4x20 | 10 | 4x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 8 | 10+20+3x20 | 10+20 | 3x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 9 | 2x10+3x20 | 2x10 | 3x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 10 | 10+2×20+2×20 | 10+2x20 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| 11 | 10+15+20+2x20 | 10+15+20 | 2x20 | As defined in Table 8.2.3.5.1-2 and Table 8.2.3.5.1-3 per CC | 8, ≥11 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B. |

##### 8.2.3.5.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.5.2-4 based on single carrier requirement specified in Table 8.2.5.2.2-2 and Table 8.2.3.5.2-3, with the addition of the parameters in Table 8.2.3.5.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.5.2-5 based on single carrier requirement specified in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3, with the addition of the parameters in Table 8.2.3.5.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.5.2-6 based on single carrier requirement specified in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3, with the addition of the parameters in Table 8.2.3.5.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.5.2-7 based on single carrier requirement specified in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3, with the addition of the parameters in Table 8.2.3.5.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.5.2-1: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | dBm/15kHz | -98 |
| PDSCH transmission mode |  | 3 |
| NOTE 1: .NOTE 2: The same PDSCH transmission mode is applied to each component carrier. |

Table 8.2.3.5.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern  | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value |
| Fraction of MaximumThroughput (%) | SNR (dB) |
| 5 MHz | R.87-2 FDD | OP.1 FDD | HST-SFN | 2x2 Low | 70 | 13.9 |
| 10 MHz | R.87 FDD | OP.1 FDD | HST-SFN | 2x2 Low | 70 | 13.3 |
| 15 MHz | R.87-3 FDD | OP.1 FDD | HST-SFN | 2x2 Low | 70 | 13.9 |
| 20 MHz | R.87-4 FDD | OP.1 FDD | HST-SFN | 2x2 Low | 70 | 14.1 |

Table 8.2.3.5.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern  | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value |
| Fraction of MaximumThroughput (%) | SNR (dB) |
| 5 MHz | R.87-2 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.1 |
| 10 MHz | R.87 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.2 |
| 15 MHz | R.87-3 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.4 |
| 20 MHz | R.87-4 TDD | OP.1 TDD | HST-SFN | 2x2 Low | 70 | 13.6 |

Table 8.2.3.5.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B |

Table 8.2.3.5.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| **Test number** | **Aggregated Bandwidth (MHz)** | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 4 | 3x20 | 2x20 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 5 | 20+20+15 | 20+15 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 6 | 20+20+10 | 20+10 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 7 | 20+10+10 | 2x10 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 8 | 10+15+20 | 10 | 15+20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| 9 | 10+15+20 | 10+15 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥5 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B. |

Table 8.2.3.5.2-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 4x20 | 20 | 3x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 2 | 4x20 | 2×20 | 2×20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 3 | 3x20+15 | 20+15 | 2×20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 4 | 2×15+2x20 | 2×15 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 5 | 3x20+15 | 2×20+15 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 6 | 2×15+2x20 | 2x15+20 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 7 | 3x20+10 | 2x20+10 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 8 | 4x20 | 3x20 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 9 | 10+3x20 | 10 | 3x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 10 | 2x10+2x20 | 2x10 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 11 | 2x10+20+15 | 2x10 | 20+15 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 12 | 10+3x20 | 10+20 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 13 | 10+15+2x20 | 10+15 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| 14 | 10+15+2x20 | 10+15+20 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | ≥8 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B. |

Table 8.2.3.5.2-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 15+4×20 | 15+2×20 | 2×20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 2 | 2×15+3×20 | 2×15+20 | 2×20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 3 | 4x20+20 | 4x20 | 20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 4 | 3x20+2x20 | 3x20 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 5 | 2x20+3x20 | 2x20 | 3X20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 6 | 20+4x20 | 20 | 4x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 7 | 10+4x20 | 10 | 4x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 8 | 10+20+3x20 | 10+20 | 3x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 9 | 2x10+3x20 | 2x10 | 3x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 10 | 10+2×20+2×20 | 10+2x20 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| 11 | 10+15+20+2x20 | 10+15+20 | 2x20 | As defined in Table 8.2.3.5.2-2 and Table 8.2.3.5.2-3 per CC | 8, ≥11 |
| NOTE: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in clause 8.1.2.3B. |

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