**3GPP TSG-RAN WG4 Meeting # 116R4-2509689**

**Bangalore, India, 25 Aug - 29 Aug, 2025**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** |  | **rev** | **-** | **Current version:** | **19.1.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Draft CR for CSSF optimization of RRM Phase 5 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | OPPO | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_RRM\_Ph5-Core | | | | |  | ***Date:*** | | | 2025-08-6 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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:*** | | Introduce the core requirements for NR Radio Resource Management (RRM) Phase 5, including CSSF optimization. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Update the following endorsed draft CRs (R4-2508319, R4-2508333) for CSSF optimization:   1. For UE supporting [new 3-searcher capability] the Enhanced CSSFoutside\_gap,i scaling factor does not apply for the E-UTRA inter-RAT MOs without MG (for the scenario of NR SA) that are being measured outside of MG. 2. For solution 1, update the requirements based on agreements in RAN4#116 meeting. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The core requirements are missing in R19 spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 9.1.5.1, 9.2.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | NA | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start of Change 1>

##### 9.1.5.1.1 EN-DC mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements and RSSI and channel occupancy measurements performed outside gaps

For UE configured with the E-UTRA-NR dual connectivity operation, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.1-1.

For UE support *FR1 only EN-DC 3-searcher capability* configured with the E-UTRA-NR dual connectivity operation and none of SMTC occasions of outside gap measurement objects in one FR are overlapped with per-FR measurement GAP (if configured) in another FR, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.1-2.

Table 9.1.5.1.1-1: CSSFoutside\_gap,i scaling factor for EN-DC mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PSCC | *CSSF*outside\_gap,i for FR1 SCC | *CSSF*outside\_gap,i for FR2 PSCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is required Note 2 | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gp |
| **EN-DC with FR1 only CA** | 1+NPSCC\_CSIRS+NPSCC\_CCA\_RSSI/CO | NSCC\_SSB +Y+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO | N/A | N/A | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO |
| **EN-DC with**  **FR2 only intra band CA** | N/A | N/A | 1+NPSCC\_CSIRS | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS | NSCC\_SSB +Y+2x NSCC\_CSIRS |
| **EN-DC with**  **FR2 only inter band CA** | N/A | N/A | 1+NPSCC\_CSIRS | 2x(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **EN-DC with**  **FR1 +FR2 CA (FR1 PSCell) Note 1** | 1+NPSCC\_CSIRS | 2×( NSCC\_SSB +Y+2xNSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | N/A | 2x(1+NSCC\_CSIRS\_FR2\_NCM) Note 3 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **EN-DC with**  **FR1 +FR2 CA (FR2 PSCell) Note 1** | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS | 1+NPSCC\_CSIRS | N/A | NSCC\_SSB+Y+2x NSCC\_CSIRS | NSCC\_SSB+Y+2x NSCC\_CSIRS |
| NOTE 1: Only one NR FR1 operating band and one NR FR2 operating band are included for FR1+FR2 inter-band EN-DC.  NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.  NOTE 3: CSSFoutside\_gap,i =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; CSSFoutside\_gap,i =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.  NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 5: Only two NR FR2 operating band are included for EN-DC with FR2 only inter-band CA  NOTE 6: NPSCC\_CSIRS=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPSCC\_CSIRS =0.  NOTE 7: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 8: NSCC\_CSIRS\_FR2\_NCM=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, NSCC\_CSIRS\_FR2\_NCM=0.  NOTE 9: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one serving CC measurement per-band* for intra-frequency measurements without MG, NSCC\_SSB is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2.  NOTE 10: NPSCC\_CCA\_RSSI/CO= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; NSCC\_CCA\_RSSI/CO = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.  NOTE 11 If a measurement object configured by PSCell and an NR inter-RAT measurement object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions [in clause 9.1.3.2], otherwise they are counted separately as two measurement objects. | | | | | | |

Table 9.1.5.1.1-2: Enhanced CSSFoutside\_gap,i scaling factor for EN-DC mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PSCC | *CSSF*outside\_gap,i for FR1 SCC | *CSSF*outside\_gap,i for FR2 PSCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is required Note 2 | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap |
| **EN-DC with FR1 only CA** | 1+NPSCC\_CSIRS+NPSCC\_CCA\_RSSI/CO | ⌈0.5×(NSCC\_SSB +Y+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO) ⌉ | N/A | N/A | N/A | ⌈0.5×(NSCC\_SSB +Y+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO) ⌉ |
| **EN-DC with**  **FR2 only intra band CA** | N/A | N/A | 1+NPSCC\_CSIRS | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS | NSCC\_SSB +Y+2x NSCC\_CSIRS |
| **EN-DC with**  **FR2 only inter band CA** | N/A | N/A | 1+NPSCC\_CSIRS | 2x(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **EN-DC with**  **FR1 +FR2 CA (FR1 PSCell) Note 1** | 1+NPSCC\_CSIRS | 2×( NSCC\_SSB +Y+2xNSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | N/A | 2x(1+NSCC\_CSIRS\_FR2\_NCM) Note 3 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **EN-DC with**  **FR1 +FR2 CA (FR2 PSCell) Note 1** | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS | 1+NPSCC\_CSIRS | N/A | NSCC\_SSB+Y+2x NSCC\_CSIRS | NSCC\_SSB+Y+2x NSCC\_CSIRS |
| NOTE 1: Only one NR FR1 operating band and one NR FR2 operating band are included for FR1+FR2 inter-band EN-DC.  NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.  NOTE 3: CSSFoutside\_gap,i =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; CSSFoutside\_gap,i =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.  NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 5: Only two NR FR2 operating band are included for EN-DC with FR2 only inter-band CA  NOTE 6: NPSCC\_CSIRS=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPSCC\_CSIRS =0.  NOTE 7: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 8: NSCC\_CSIRS\_FR2\_NCM=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, NSCC\_CSIRS\_FR2\_NCM=0.  NOTE 9: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.  NOTE 10: NPSCC\_CCA\_RSSI/CO= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; NSCC\_CCA\_RSSI/CO = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.  NOTE 11: If a measurement object configured by PSCell and an NR inter-RAT measurement object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions [in clause 9.1.3.2], otherwise they are counted separately as two measurement objects. | | | | | | |

##### 9.1.5.1.2 SA mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements and RSSI and channel occupancy measurements performed outside gaps

For UE in SA operation mode, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, E-UTRA inter-RAT measurement object without measurement gap, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.2-1, which shall also be applied for a UE configured with NE-DC operation.

For UE supports *FR1 only CA and FR1 only NR-DC 3-searcher capability* or *FR1+FR2 CA (PCell is FR1 only) 3-searcher capability* in SA operation mode and none of SMTC occasions of outside gap measurement objects in one FR are overlapped with per-FR measurement GAP (if configured) in another FR, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, E-UTRA inter-RAT measurement object without measurement gap, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.2-2.

Table 9.1.5.1.2-1: CSSFoutside\_gap,i scaling factor for SA mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PCC | *CSSF*outside\_gap,i for FR1 SCC | *CSSF*outside\_gap,i for FR2 PCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is required | *CSSF* outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap | *CSSF*outside\_gap,i for E-UTRA inter-RAT MO with no measurement gap |
| **FR1 only CA** | 1+NPCC\_CSIRS + NPCC\_CCA\_RSSI/CO | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO | N/A | N/A | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| **FR2 only intra band CA** | N/A | N/A | 1+NPCC\_CSIRS | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| **FR2 only inter band CA** | N/A | N/A | 1+NPCC\_CSIRS | 2\*(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **FR1 +FR2 CA (FR1 PCell) Note 1** | 1+NPCC\_CSIRS | 2×( NSCC\_SSB +Y+Z+2\* NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | N/A | 2x(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **FR1 +FR2 CA (FR2 PCell) Note 1** | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | 1+NPCC\_CSIRS | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| NOTE 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.  NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.  NOTE 3: CSSFoutside\_gap,i =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; CSSFoutside\_gap,i =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.  NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 5: Only two NR FR2 operating bands are included for FR2 inter-band CA.  NOTE 6: NPCC\_CSIRS=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPCC\_CSIRS =0.  NOTE 7: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 8: NSCC\_CSIRS\_FR2\_NCM=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, NSCC\_CSIRS\_FR2\_NCM=0.  NOTE 9: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one serving CC measurement per-band* for intra-frequency measurements without MG, NSCC\_SSB is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2.  NOTE 10: NPCC\_CCA\_RSSI/CO= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; NSCC\_CCA\_RSSI/CO = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.  NOTE 11: Z is the number of configured E-UTRA inter-RAT MOs without MG that are being measured outside of MG; otherwise, it is 0. | | | | | | | |

Table 9.1.5.1.2-2: Enhanced CSSFoutside\_gap,i scaling factor for SA mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PCC | *CSSF*outside\_gap,i for FR1 SCC | *CSSF*outside\_gap,i for FR2 PCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is required | *CSSF* outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap | *CSSF*outside\_gap,i for E-UTRA inter-RAT MO with no measurement gap |
| **FR1 only CA Note12** | 1+NPCC\_CSIRS + NPCC\_CCA\_RSSI/CO | 0.5×(NSCC\_SSB +2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO) +Y+Z | N/A | N/A | N/A | 0.5×(NSCC\_SSB +2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO) +Y+Z | (NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| **FR2 only intra band CA** | N/A | N/A | 1+NPCC\_CSIRS | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| **FR2 only inter band CA** | N/A | N/A | 1+NPCC\_CSIRS | 2\*(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **FR1 +FR2 CA (FR1 PCell) Note 1, Note 12** | 1+NPCC\_CSIRS | NSCC\_SSB+2\*(Y+Z) +2\* NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM | N/A | 1+ NSCC\_CSIRS\_FR2\_NCM Note 3,5 | NSCC\_SSB+Y+Z +2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM | NSCC\_SSB+2\*(Y+Z)+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM | 2 x ( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **FR1 +FR2 CA (FR2 PCell) Note 1** | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | 1+NPCC\_CSIRS | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| NOTE 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.  NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.  NOTE 3: CSSFoutside\_gap,i =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; CSSFoutside\_gap,i =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.  NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 5: Only two NR FR2 operating bands are included for FR2 inter-band CA.  NOTE 6: NPCC\_CSIRS=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPCC\_CSIRS =0.  NOTE 7: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 8: NSCC\_CSIRS\_FR2\_NCM=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, NSCC\_CSIRS\_FR2\_NCM=0.  NOTE 9: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.  NOTE 10: NPCC\_CCA\_RSSI/CO= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; NSCC\_CCA\_RSSI/CO = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.  NOTE 11: Z is the number of configured E-UTRA inter-RAT MOs without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 12: For UE supporting *FR1 only CA and FR1 only NR-DC 3-searcher capability* or *FR1+FR2 CA (PCell is FR1 only) 3-searcher capability* in SA operation mode, the Enhanced CSSFoutside\_gap,i scaling factor does not apply for the E-UTRA inter-RAT MOs without MG that are being measured outside of MG.. | | | | | | | |

##### 9.1.5.1.3 NR-DC mode: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed outside gaps

For UE configured with NR-DC operation, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurement, inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in table 9.1.5.1.3-1.

For UE supports *FR1 only CA and FR1 only NR-DC 3-searcher capability* or *FR1+FR2 NR-DC (PCell is FR1 only) 3-searcher capability* configured with NR-DC operation and none of SMTC occasions of outside gap measurement objects in one FR are overlapped with per-FR measurement GAP (if configured) in another FR, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurement, inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in table 9.1.5.1.3-2.

Table 9.1.5.1.3-1: CSSFoutside\_gap,i scaling factor for NR-DC mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PCC | *CSSF*outside\_gap,i for FR1 SCC | CSSFoutside\_gap,i for FR1 PSCC | *CSSF*outside\_gap,i for FR2 PSCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap |
| **FR1 + FR2 NR-DC (FR1 PCell and FR2 PSCell) Note 1** | 1+NPCC\_CSIRS | 2×( NSCC\_SSB +Y+2xNSCC\_CSIRS) | N/A | 2x(1+ NPSCC\_CSIRS) Note 2 | 2x(NSCC\_SSB +Y+2x NSCC\_CSIRS ) | 2x(NSCC\_SSB +Y+2x NSCC\_CSIRS ) |
| **FR1 + FR1 NR-DC (FR1 PCell and FR1 PSCell)** | 1+NPCC\_CSIRS | 2×( NSCC\_SSB +Y+2xNSCC\_CSIRS) | 2x(1+ NPSCC\_CSIRS) Note 2 | N/A | N/A | 2x(NSCC\_SSB +Y+2x NSCC\_CSIRS ) |
| NOTE 1: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.  NOTE 2: CSSFoutside\_gap,i =1 if no SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on PSCC; CSSFoutside\_gap,i =2 if no SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on PSCC.  NOTE 3: Y is the number of configured inter-frequency SSB based frequency layers without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 4: NPCC\_CSIRS=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPCC\_CSIRS =0.  NOTE 5: NPSCC\_CSIRS=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPSCC\_CSIRS =0.  NOTE 6: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 8: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one CC measurement per-band* for intra-frequency measurements without MG, NSCC\_SSB is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2. | | | | | | |

Table 9.1.5.1.3-2: Enhanced CSSFoutside\_gap,i scaling factor for NR-DC mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PCC | *CSSF*outside\_gap,i for FR1 SCC | CSSFoutside\_gap,i for FR1 PSCC | *CSSF*outside\_gap,i for FR2 PSCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap |
| **FR1 + FR2 NR-DC (FR1 PCell and FR2 PSCell) Note 1** | 1+NPCC\_CSIRS | ( NSCC\_SSB +Y+2xNSCC\_CSIRS) | N/A | (1+ NPSCC\_CSIRS) Note 2 | (NSCC\_SSB +Y+2x NSCC\_CSIRS ) | (NSCC\_SSB +Y+2x NSCC\_CSIRS ) |
| **FR1 + FR1 NR-DC (FR1 PCell and FR1 PSCell)** | 1+NPCC\_CSIRS | ( NSCC\_SSB +Y+2xNSCC\_CSIRS) | (1+ NPSCC\_CSIRS) Note 2 | N/A | N/A | (NSCC\_SSB +Y+2x NSCC\_CSIRS ) |
| NOTE 1: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.  NOTE 2: CSSFoutside\_gap,i =1 if no SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on PSCC; CSSFoutside\_gap,i =2 if no SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on PSCC.  NOTE 3: Y is the number of configured inter-frequency SSB based frequency layers without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 4: NPCC\_CSIRS=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPCC\_CSIRS =0.  NOTE 5: NPSCC\_CSIRS=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPSCC\_CSIRS =0.  NOTE 6: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 8: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. | | | | | | |

##### 9.1.5.1.4 NE-DC mode: carrier-specific scaling factor for SSB-based and CSI-RS based measurements performed outside gaps

For UE configured with NE-DC operation, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurement and inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in table 9.1.5.1.4-1.

Table 9.1.5.1.4-1: CSSFoutside\_gap,i scaling factor for NE-DC mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PCC | *CSSF*outside\_gap,i for FR1 SCC | *CSSF*outside\_gap,i for FR2 PCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is required | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap |
| **NE-DC with FR1 only CA** | 1+NPCC\_CSIRS | NSCC\_SSB +Y+2x NSCC\_CSIRS | N/A | N/A | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS |
| **NE-DC with FR2 only intra band CA** | N/A | N/A | 1+NPCC\_CSIRS | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS | NSCC\_SSB +Y+2x NSCC\_CSIRS |
| **NE-DC with**  **FR2 only inter band CA** | N/A | N/A | 1+NPCC\_CSIRS | 2\*(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **NE-DC with FR1 +FR2 CA (FR1 PCell) Note 1** | 1+NPCC\_CSIRS | 2×( NSCC\_SSB +Y+2\* NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | N/A | 2x(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| NOTE 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.  NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.  NOTE 3: CSSFoutside\_gap,i =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; CSSFoutside\_gap,i =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.  NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 5: Only two NR FR2 operating band are included for NE-DC with FR2 only inter-band CA.  NOTE 6: NPCC\_CSIRS=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPCC\_CSIRS =0.  NOTE 7: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 8: NSCC\_CSIRS\_FR2\_NCM=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, NSCC\_CSIRS\_FR2\_NCM=0.  NOTE 9: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one serving CC measurement per-band* for intra-frequency measurements without MG, NSCC\_SSB is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2. | | | | | | |

<End of Change 1>

<Start of Change 2>

#### 9.2.3.2 Requirements for FR2

For UE supporting *CSSF enhancement for one serving CC measurement per-band*, if UE receives network indication via *enable one serving carrier measurement in a band* to enable one serving carrier measurement for an FR2 band,

For one single intra-frequency layer in a band, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 6 identified cells, and

- 24 SSBs with different SSB index and/or PCI,

where this single intra-frequency layer shall be:

- PCC, when UE is configured with SA NR or NE-DC operation mode with PCC in the band; or

- PSCC, when UE is configured with EN-DC with PSCC in the band; or

- PSCC, when UE is configured with NR-DC with PSCC in the band; or

- an SCC, if such SCC is the only one SCC on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band; or

- an SCC, indicated by network via *enable one serving carrier measurement in a band*, if such SCC is one of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band;

- otherwise

- one SCC determined by UE implementation.

UE is not required to perform SS-RSRP, SS-RSRQ, and SS-SINR measurements on both serving and neighbour cell for each of the other intra-frequency layer(s) in the same band.

For UE not supporting *CSSF enhancement for one serving CC measurement per-band*, or UE supporting *CSSF enhancement for one serving CC measurement per-band* but does not receive network indication via *enable one serving carrier measurement in a band* to enable one serving carrier measurement for each FR2 band,

For one single intra-frequency layer in a band, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 6 identified cells, and

- 24 SSBs with different SSB index and/or PCI,

where this single intra-frequency layer shall be:

- PCC when UE is configured with SA NR operation mode with PCC in the band; or

- PSCC when UE is configured with EN-DC with PSCC in the band; or

- PSCC when UE is configured with NR-DC with PSCC in the band; or

- One of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with SS-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.

The UE shall also be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least 2 SSBs on serving cell for each of the other intra-frequency layer(s) in the same band.

<End of Change 2>