**3GPP TSG- RAN4 Meeting # 116bis *R4-2514846***

**Prague, Czech Republic, Oct. 13-17, 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.133** | **CR** | **-** | **rev** | **1** | **Current version:** | **19.2.0** |  |
|  | | | | | | | | |
| *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:*** | Correction on low band carrier aggregation via switching | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_LBCA\_Sw-Core | | | | |  | ***Date:*** | | | 2025-10-17 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***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:*** | | Correct the UE capability  Correct the conditions of Noutside\_MG from “or”to “and” | | | | | | | | |
| ***s*** | |  | | | | | | | | |
| ***Summary of change:*** | | Correct the UE capability  Correct the conditions of Noutside\_MG from “or”to “and”Correct the conditions of Noutside\_MG from “or”to “and” | | | | | | | | |
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| ***Consequences if not approved:*** | | The RRM requirements for supporting intra-band non-collocated NR-CA. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 9.5.4.1, 9.5.4.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

### <Unchanged Text Skipped>

### 9.5.4 L1-RSRP measurement requirements

#### 9.5.4.1 SSB based L1-RSRP Reporting

When *groupBasedBeamReporting-r17* is not configured, the UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB.

When *groupBasedBeamReporting-r17* is configured, the UE shall be capable of performing L1-RSRP measurements based on the two configured SSB resource sets for L1-RSRP, and the UE physical layer shall be capable of reporting group-based L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB.

When there is no L1-RSRP measurement on LTM neighbor cell(s) to measure within active BWP, the value of TL1-RSRP\_Measurement\_Period\_SSB is defined in table 9.5.4.1-1 for FR1, the value of TL1-RSRP\_Measurement\_Period\_SSB is defined in table 9.5.4.1-2 for FR2 when *highSpeedMeasFlagFR2-r17* is not configured and if *groupBasedBeamReporting-r17* is not configured, and defined in table 9.5.4.1-2A for FR2-1 when *highSpeedMeasFlagFR2-r17* is not configured and if *groupBasedBeamReporting-r17* is configured, and defined in table 9.5.4.1-3 for FR2 power class 6 UE when *highSpeedMeasFlagFR2-r17* is configured, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- The value of N in table 9.5.4.1-2A is 2, 4 or 6 in FR2-1 for UE supporting *fastBeamSweepingMultiRx-r18* according to the conditions described in clause 3.6.19.

- The value of N in table 9.5.4.1-2 is 8.

- The value of N in table 9.5.4.1-3 is 8.

For a UE supporting *LowBandCA-via-Switching-r19, or* for a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both concurrent GAP and *musim-GapPreference-r17* and when concurrent gaps or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured,

- an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8 and 9.1.10,

- P value for SSB resource to be measured is defined as

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, xRP\_max, switching pattern periodicity), where xRP\_max is the maximum xRP across all configured per-UE GAPs , periodic MUSIM gap(s) and per-FR GAPs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:

Ntotal is the total number of SSB resource occasions within the window, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasionswithin the window.

For UEs supporting *LowBandCA-via-Switching-r19* and configured with low NR inter-band carrier aggregation:

- for the PCell L1-RSRP measurement, Ntotal also includes SSB resource occasions that overlap with the SDL SCell ON duration within the window,

- for the SCell L1-RSRP measurement, Ntotal also includes SSB resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and

- Noutside\_MG is the number of SSB resource occasions within the window W

- that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, and

- that are not overlapped with SDL SCell ON duration corresponding to the LB CA switching pattern, for the PCell L1-RSRP measurement for a UE supporting *LowBandCA-via-Switching-r19* with low NR inter-band carrier aggregation configured or

- that are not overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the SCell L1-RSRP measurement for a UE supporting *LowBandCA-via-Switching-r19* with low NR inter-band carrier aggregation configured, and

- L1-RSRP requirement in this clause is not applied when Noutside\_MG = 0.

- Navailable is the number of SSB resource occasions that are not overlapped with any non-dropped GAP occasion, non-dropped MUSIM gap occasion nor any SMTC occasion within the window W.

- for UEs supporting *LowBandCA-via-Switching-r19*, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.

- an SSB or an SMTC occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion.

- TL1 is periodicity of the target SSB.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s) and UE does not support *musim-GapPreference-r17* or when no MUSIM gaps are configured,

For FR1,

- P=, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

For FR2,

P1=, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P1 is PL1\_sharing\*Psharing factor, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- P1=, when SSB is partially overlapped with GAP and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5\*TSMTCperiod

- P is , when SSB is partially overlapped with GAP and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TSSB = 0.5\*TSMTCperiod

- P1=, when SSB is partially overlapped with GAP (TSSB < xRP) and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP.

- P is , when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

- If SSB resource from the cell with different PCI is configured for L1-RSRP measurement, and P2 is valid accoding to clause 9.13.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain)

- P = , if P1\*TSSB < P2\*TSSB\_CDP.

- P = P1, if P1\*TSSB > P2\*TSSB\_CDP.

- P = 2\*P1, if P1\*TSSB = P2\*TSSB\_CDP.

- Otherwise, P = P1

Where:

- TSSB = *ssb-periodicityServingCell* of the serving cell

- TSMTCperiod = the configured SMTC period

- TSSB\_CDP = SSB periodicity of the cell with PCI different from serving cell

- Psharing factor = 1, if the SSB configured for L1-RSRP measurement outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- PL1\_sharing = 2, if SSB resource from the cell with different PCI is configured for L1-RSRP measurement, and Psharing\_factor,CDP is used in clause 9.13.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain). PL1\_sharing = 1, otherwise.

- TSSB = *ssb-periodicityServingCell*

- TSMTCperiod = the configured SMTC period

- When a measurement gap is configured and the measurement gap is not NCSG,

- an SSB or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG, an SSB or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- an SSB or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

The value of TL1-RSRP\_Measurement\_Period\_SSB is defined in table 9.5.4.1-4 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR1, table 9.5.4.1-5 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR1, table 9.5.4.1-6 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR2 and table 9.5.4.1-7 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR2 when there is L1-RSRP measurement on LTM neighbor cell(s) to measure within active BWP, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- N= 8 in table 9.5.4.1-6 and table 9.5.4.1-7.

- P value for SSB resource to be measured is defined as

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 with Navailable > 0

For a window W of duration max (TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:

- Ntotal is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and

- Noutside\_MG is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W

- TL1 is periodicity of the target SSB.

- Psharing factor = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- Psharing factor = 3, otherwise.

- PL1\_sharing is defined as

- When number of neighboring cells configured with SSB based L1-RSRP measurement is 1

- PL1\_sharing = 2, if any symbol of the SSBs from serving cell and neighbor cell are overlapping or adjacent (in time domain)

- PL1\_sharing = 1, otherwise

- When number of neighboring cells configured with SSB based L1-RSRP measurement is more than 1

- PL1\_sharing = 3.

Note: RRM requirements are not applicable when L1 measurement on the cells with different PCI and LTM L1 measurement on neighbour cells are both configured.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and GAP configurations does not meet previous conditions.

When UE is configured with aperiodic MUSIM gap and the aperiodic MUSIM gap is overlapping with SSB resource occasion for L1-RSRP, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and SSB resource occasions for L1-RSRP are fully overlapped with MUSIM gap(s) or fully overlapped with the union of MUSIM gap(s) and GAPs, no requirement applies for the SSB based L1-RSRP measurement.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 9.5.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: K = 1 when TSSB ≤ 40 ms and *highSpeedMeasFlag-r16 or highSpeedMeasCA-Scell-r17* are configured; otherwise, K = 1.5.  Note 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16. or measurementEnhancementCA-r17* | |

Table 9.5.4.1-2: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. | |

Table 9.5.4.1-2A: Measurement period TL1-RSRP\_Measurement\_Period\_SSB configured with *groupBasedBeamReporting-r17* for FR2-1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note1: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. | |

**Table 9.5.4.1-3: Measurement period TL1-RSRP\_Measurement\_Period\_SSB configured with *highSpeedMeasFlagFR2-r17* for FR2-1**

|  |  |
| --- | --- |
| **Configuration** | **TL1-RSRP\_Measurement\_Period\_SSB (ms)** |
| non-DRX | max(TReport, ceil(M\*P\*N1Note2)\*TSSB) |
| DRX cycle ≤ 80 ms | max(TReport, ceil(M\*P\*N1Note2\*M2)\*max(TDRX,TSSB)) |
| 80 ms< DRX ≤ 320 ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note1: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: Scaling factor N1 = 2 when *highSpeedMeasFlagFR2-r17* = set1 or scaling factor N1 = 6 when *highSpeedMeasFlagFR2-r17* = set2, if UE does not support *simultaneousReceptionTwoQCL-r18* or when *highSpeedDeploymentTypeFR2-r17* is not configured as bidirectional. Scaling factor N1 = 1.5 when *highSpeedMeasFlagFR2-r17* is configured to set1 or scaling factor N1 = 4 when *highSpeedMeasFlagFR2-r17* is configured to set2, if UE supports *simultaneousReceptionTwoQCL-r18* and when *highSpeedDeploymentTypeFR2-r17* is configured as bidirectional.  Note 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 | |

Table 9.5.4.1-4: Measurement period TL1-RSRP\_Measurement\_Period\_SSB in FR1 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: K = 1.5.  Note 3: The requirements apply if the actual RTD between serving cell and neighbor cell is not larger than CP. | |

Table 9.5.4.1-5: Measurement period TL1-RSRP\_Measurement\_Period\_SSB in FR1 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: K = 1.5. | |

Table 9.5.4.1-6: Measurement period TL1-RSRP\_Measurement\_Period\_SSB in FR2 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P\*PL1\_sharing\*N)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P\*PL1\_sharing \*N)\*max(TDRX,TSSB) ) |
| DRX cycle > 320 ms | ceil(1.5\*M\*P\*PL1\_sharing\*N)\*TDRX |
| Note 1: TSSB *= ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: The requirements apply if the actual RTD between serving cell and neighbor cell is not larger than CP. | |

Table 9.5.4.1-7: Measurement period TL1-RSRP\_Measurement\_Period\_SSB in FR2 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P\*PL1\_sharing\*N)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P\*PL1\_sharing\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(1.5\*M\*P\*PL1\_sharing\*N)\*TDRX |
| NOTE 1: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. | |

#### 9.5.4.2 CSI-RS based L1-RSRP Reporting

When *groupBasedBeamReporting-r17* is not configured, the UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_CSI-RS.

When *groupBasedBeamReporting-r17* is configured, the UE shall be capable of performing L1-RSRP measurements based on the two configured CSI-RS resource sets for L1-RSRP, and the UE physical layer shall be capable of reporting group-based L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_CSI-RS.

The value of TL1-RSRP\_Measurement\_Period\_CSI-RS is defined in table 9.5.4.2-1 for FR1 and in table 9.5.4.2-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- For aperiodic CSI-RS resources M=1

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set) for table 9.5.4.2-2, where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clauses 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For a UE supporting *LowBandCA-via-Switching-r19*, or for a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both concurrent measurement gap and *musim-GapPreference-r17* and when concurrent gaps or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured,

- a CSI-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clauses 9.1.8 and 9.1.10,

- P value for a CSI-RS resource to be measured is defined as

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, xRP\_max, switching pattern periodicity), where xRP\_max is the maximum xRP across all configured per-UE measurement gaps or NCSGs, MUSIM gap(s)and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CSI-RS resource occasion:

- Ntotal is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions, MUSIM gap occasions or SMTC occasions within the window W.

For UEs supporting *LowBandCA-via-Switching-r19* and configured with low NR inter-band carrier aggregation:

- for the PCell L1-RSRP measurement, Ntotal also includes CSI-RS resource occasions that overlap with the SDL SCell ON duration within the window,

- for the SCell L1-RSRP measurement, Ntotal also includes CSI-RS resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and

- Noutside\_MG is the number of CSI-RS resource occasions within the window W

- that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, and

- that are not overlapped with SDL SCell ON duration corresponding to the LB CA switching pattern, for the PCell L1-RSRP measurement for a UE supporting *LowBandCA-via-Switching-r19* with low NR inter-band carrier aggregation configured or

- that are not overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the SCell L1-RSRP measurement for a UE supporting *LowBandCA-via-Switching-r19* with low NR inter-band carrier aggregation configured, and

- L1-RSRP requirement in this clause is not applied when Noutside\_MG = 0.

- Navailable is the number of CSI-RS resource occasions that are not overlapped with any non-dropped GAP occasions, non-dropped MUSIM gap occasion nor any SMTC occasion within the window W.

- for UEs supporting *LowBandCA-via-Switching-r19*, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.

- a CSI-RS or an SMTC occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

- TL1 is periodicity of the target CSI-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s), and UE does not support *musim-GapPreference-r17* or when no MUSIM gaps are configured.

For FR1,

- P=, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when CSI-RS is not overlapped with a GAP and also not overlapped with SMTC occasion.

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is not overlapped with SMTC occasion (TCSI-RS < xRP)

- P=, when CSI-RS is not overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P=Psharing factor, when CSI-RS is not overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P=1, when aperiodic CSI-RS resource is not overlapped with GAP

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TCSI-RS = 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with GAP (TCSI-RS < xRP) and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP.

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

Where:

- Psharing factor = 1, if the CSI-RS configured for L1-RSRP measurement outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

TSMTCperiod = the configured SMTC period.

TCSI-RS = the periodicity of CSI-RS configured for L1-RSRP measurement

- When a measurement gap is configured and the measurement gap is not NCSG,

- a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if it overlapps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG, a CSI-RS or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

When UE is configured with aperiodic MUSIM gap and the aperiodic MUSIM gap is overlapping with CSI-RS resource occasion for L1-RSRP, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and CSI-RS resource occasions for L1-RSRP are fully overlapped with MUSIM gap(s) or fully overlapped with the union of MUSIM gap(s) and GAPs, no requirement applies for the CSI-RS based L1-RSRP measurement.

Table 9.5.4.2-1: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE 1: TCSI-RS is the periodicity of CSI-RS configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.  NOTE 3: K = 1 when TCSI-RS ≤ 40 ms and *highSpeedMeasFlag-r16 or highSpeedMeasCA-Scell-r17* are configured; otherwise K = 1.5.  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16 or measurementEnhancementCA-r17.* | |

Table 9.5.4.2-2: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320 ms | ceil(M\*P\*N)\*TDRX |
| NOTE 1: TCSI-RS is the periodicity of CSI-RS configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. | |

### <Unchanged Text Skipped>