**3GPP TSG-RAN WG4 Meeting #111 R4-240xxxx**

Fukuoka City, Fukuoka , Japan, 20th – 24th May, 2024

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.133** | **CR** |  | **rev** |  | **Current version:** | **18.5.0** |  |
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| *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:*** | draft CR on L1-RSRP RRM requirements in R18 LTM | | | | | | | | | |
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| ***Source to WG:*** | vivo | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_Mob\_enh2-Core | | | | |  | ***Date:*** | | | 2024-05-13 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 17) Rel-17 (Release 18) Rel-18 (Release 19) Rel-19 (Release 20)* | |
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| ***Reason for change:*** | | 1. Re-submit endored version of R4-2406513  2. Capture the refined wording of ‘Consequence if not approved’ for 39-3-1/2/3/4/5/6, based on the agreed UE feature table in R4-2406680, with further calrifications to 39-1 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Re-submit endored version of R4-2406513  2. Capture the refined wording of ‘Consequence if not approved’ for 39-3-1/2/3/4/5/6, based on the agreed UE feature table in R4-2406680, with further calrifications to 39-1 | | | | | | | | |
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| ***Consequences if not approved:*** | | 1. Endorsed version of R4-2406513 is not agreed.  3. The UE behaviour regarding restrictions on measurement based on UE capabilities is not reflected in spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 9.14, 9.15.4, 9.15.1, 9.15.4, 9.15.5.1, 9.15.6.1.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.533 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R4-2406513 | | | | | | | | |

<Start of Change #1>

## 9.14 Intra-frequency L1-RSRP measurements for neighbor cell

### 9.14.1 Introduction

A measurement is defined as an SSB based intra-frequency L1-RSRP measurement provided the centre frequency of the SSB of the serving cell and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

When configured with [*LTM-CSI-ResourceConfig-r18*] by the network, the UE shall be able to perform L1-RSRP measurements of configured measurement resources from a neighbor cell, with the measurement resources configured as SSBs of the neighbor cell.

If the number of resources/cells, including the number of resources/cells configured for L1-RSRP measurement in 9.14 exceeds the UE capability specified in 9.14.4, it is up to UE implementation on how to choose cells/SSB to measure, and the cells whose TCI state(s) are in the active TCI state list shall be prioritized.

The UE shall report the measurement quantity and send periodic, semi-persistent or aperiodic reports, according to the higher layer parameter [*reportConfigType-r18*] of each reporting setting[*LTM-CSI-ReportConfig-r18*].

### 9.14.2 Requirements Applicability

The requirements in the clause 9.14 are applicable to FR1 and FR2-1 for LTM.

The requirements in clause 9.14 apply, provided for the SSB from the neighbor cell configured for intra-frequency L1-RSRP measurement, the following conditions are met:

- The cell is known

- The SSB configured for intra-frequency L1-RSRP measurement is on the same carrier frequency of SSB configured for L3 intra-frequency measurement.

- The SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP for neigbor cell shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clause [10.1.19] for FR1 and [10.1.20] for FR2-1, respectively, for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex [B.2.4.1] for a corresponding band.

The cell is considered as known if the following conditions are met in this requirement:

- The UE has performed L3 measurement on the target cell during the last 5 seconds, and

- The SSB from the target cell configured for L1 measurement remains detectable according to the cell identification requirements specified in clause 9.2.

Otherwise, the cell is unknown.

Unchanged sections omitted

### 9.14.4 Number of layers, number of cells and number of SSB

For UE supporting *[45-1 in RAN1 feature list]* but not supporting *[39-2 in RAN4 feature list]*, UE shall support performing LTM L1-RSRP measurements on NL1, outside\_gap SSB frequency layers, while NL1, outside\_gap is the number of intra-frequency SSB layers as indicated in [39-3-1].

For UE supporting *[45-1 in RAN1 feature list]* and *[39-2 in RAN4 feature list]*, UE shall support performing LTM L1-RSRP measurements on NL1, outside\_gap SSB frequency layers, while NL1, outside\_gap is the number of intra-frequency SSB layers plus inter-frequency without gaps SSB layers as indicated in [39-3-1].

For each intra-frequency layer,

* If UE has reported NNeigh\_Cell in [39-3-2], the UE shall be capable of performing L1-RSRP measurements for at least NNeigh\_Cell neighbor cells.
* If UE has reported Nmax\_SSB in [39-3-5], the UE shall be capable of performing L1-RSRP measurements for at least Nmax\_SSB SSB resources including serving cell SSBs and neighbour cell SSBs.

If UE has reported NTotal\_Cell in [39-3-3], the UE shall be capable of performing L1-RSRP measurements for at least NTotal\_Cell cells, including serving cells and neighbor cells, across all frequency layers of intra-frequency and inter-frequency without measurement gaps.

If UE has reported NSSB\_within\_slot in [39-3-4], the UE shall be capable of performing L1-RSRP measurements for at least NSSB\_within\_slot SSBs for serving cells and neighbor cells within a slot, across all frequency layers of intra- and inter-frequency without gap L1-RSRP measurement.

If UE has reported NTotal\_SSB in [39-3-6], the UE shall be capable of performing L1-RSRP measurements for at least NTotal\_SSB SSBs for serving cells and neighbor cells, across all frequency layers of intra- and inter-frequency without gap L1-RSRP measurement.

For L1-RSRP measurement on neighbour cell, UE measures only one intra-frequency layer on each FR2 band in CA scenario, where this single intra-frequency layer shall be the same frequency layer that UE performs L3 intra-frequency layer in that FR2 band.

### 9.14.5 L1-RSRP measurement requirements without measurement gaps

#### 9.14.5.1 SSB based L1-RSRP Reporting

The requirements specified in this clause are only applicable when

- *highSpeedMeasFlag-r16* is not configured, and

- *highSpeedMeasFlagFR2-r17* is not configured, and

- highSpeedMeasCA-Scell-r17 is not configured.

- The SSB from the neighbor cell completely contained in the active BWP of the UE

If a neighbor cell is known according 9.14.2, 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\_intra if *deriveSSB-IndexFromCell* is enabled or UE has reported SSB index in L3 measurement report of the same cell. Otherwise, UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB\_intra+TSSB\_time\_index\_intra, where TSSB\_time\_index\_intra is the time period used to acquire the index of the SSB being measured given in Table 9.2.5.1-3.

The value of TL1-RSRP\_Measurement\_Period\_SSB\_intra is defined for FR1 in Table 9.14.5.1-1 for UE incapable of [*capability of measurement with RTD>CP*] and in Table 9.14.5.1-2 for UE capable of [*capability of measurement with RTD>CP*]. The value of TL1-RSRP\_Measurement\_Period\_SSB\_intra is defined for FR2 in Table 9.14.5.1-3 for UE incapable of [*capability of measurement with RTD>CP*] and in Table 9.14.5.1-4 for UE capable of [*capability of measurement with RTD>CP*], where

- M=1.

- N= 8.

- 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 to be measured is more than 1

- When none of TCI state(s) of the intra-frequency neighbor cells or inter-frequency neighbor cells without gap are in the active TCI state list

- PL1\_sharing = 3\*NNeighbor\_Cell, where NNeighbor\_Cell is the number of neighbor cells to measure on intra-frequency and inter-frequency without gap

- Otherwise

- PL1\_sharing = 3\*NNeighbor\_Cell\_in\_list, where NNeighbor\_Cell\_in\_list is the number of neigbour cells (including intra-frequency neighbor cell(s) and inter-frequency neighbor cell(s) without gap)whose TCI state(s) are in the active TCI state list No requirements are defined for any other cell(s) whose TCI state(s) is not in the active TCI state list.

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 measurement period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 cell, longer measurement 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 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 9.14.5.1-1: Intra-frequency L1-RSRP measurement period TL1-RSRP\_Measurement\_Period\_SSB\_intra in FR1 for UE incapable of [*capability of measurement with RTD>CP*]

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB\_NBC) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB\_NBC)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency 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 when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer.  Note 4: If in one active BWP, there are more than one LTM L1 measurement frequency layers, the requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement in the same active BWP is not larger than CP length of the cells in the same active BWP. | |

Table 9.14.5.1-2: Intra-frequency L1-RSRP measurement period TL1-RSRP\_Measurement\_Period\_SSB\_intra in FR1 for UE capable of [*capability of measurement with RTD>CP*]

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB\_NBC\*NLayer) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB\_NBC) \*NLayer) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX\*NLayer |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. [NLayer = the number of intra-frequency layers configured for L1-RSRP measurement with [*LTM-CSI-ResourceConfig-r18*] + the number of inter-frequency layers without measurement gaps which are configured for L1-RSRP measurement with [*LTM-CSI-ResourceConfig-r18*]].  Note 2: K = 1.5.  Note 3:UE shall at least measure neighbour cells which are activated for TCI state within UE capability and additional cells to measure is up to UE implementation. | |

Table 9.14.5.1-3: Intra-frequency L1-RSRP measurement period TIntra\_ L1-RSRP\_Measurement\_Period\_SSB in FR2 for UE incapable of [*capability of measurement with RTD>CP*]

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P\*PL1\_sharing\*N)\*TSSB\_NBC) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*PL1\_sharing \*N)\*max(TDRX,TSSB\_NBC) ) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*PL1\_sharing\*N)\*TDRX |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: The requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer.  Note3: When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of these neighbor cells is in the active TCI state list, the requirements apply only to the cell(s) that have TCI state(s) is in the active TCI state list.  Note 4: If in one active BWP, there are more than one LTM L1 measurement frequency layers, the requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement in the same active BWP is not larger than CP length of the cells in the same active BWP. | |

Table 9.14.5.1-4: Intra-frequency L1-RSRP measurement period TL1-RSRP\_Measurement\_Period\_SSB\_intra in FR2 for UE capable of [*capability of measurement with RTD>CP*]

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_intra (ms) |
| non-DRX | max(TReport, ceil(M\*P\*PL1\_sharing\*N)\*TSSB\_NBC) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*PL1\_sharing\*N)\*max(TDRX,TSSB\_NBC)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*PL1\_sharing\*N)\*TDRX |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of these neighbor cells is in the active TCI state list, the requirements apply only to the cell(s) that have TCI state(s) is in the active TCI state list. | |

<End of Change #1>

<Start of Change #2>

### 9.15.1 Introduction

A L1-RSRP measurement is defined as an inter-frequency L1-RSRP measurement provided it is not defined as an intra- frequency L1-RSRP measurement according to clause 9.14.

For UE supporting *ltm-InterFreqMeasGap-r18*, when measurement gaps are provided, the UE shall be able to perform inter-frequency L1-RSRP measurements of SSBs from inter-frequency neighbor cells if SSBs are outside active BWPs. The UE shall be able to measure SSB resources within the *LTM-CSI-ResourceConfig-r18* settings configured for L1-RSRP measurement on inter-frequency neighbor cells with measurement gaps. If the number of resources exceeds the UE capability specified in 9.15.4, it is up to UE implementation on how to choose resources to measure, and the cell(s) whose TCI state(s) are in the active TCI state list shall be prioritized.

For UE supporting *[39-2 in RAN4 feature list]*, when measurement gaps are provided, the UE shall be able to perform inter-frequency L1-RSRP measurements of SSBs from inter-frequency neighbor cells if SSBs are within active BWPs. The UE shall be able to measure SSB resources within the *LTM-CSI-ResourceConfig-r18* settings configured for L1-RSRP measurement on inter-frequency neighbor cells without measurement gaps. If the number of resources exceeds the UE capability specified in 9.14.4, it is up to UE implementation on how to choose resources to measure, and the cell(s) whose TCI state(s) are in the active TCI state list shall be prioritized.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the higher layer parameter *reportConfigType-r18*of each reporting setting *LTM-CSI-ReportConfig-r18*.

Unchanged sections omitted

### 9.15.4 Number of cells and number of SSB

For UE supporting *ltm-InterFreqMeasGap-r18*, UE shall support performing LTM L1-RSRP measurements on NL1, inter\_with\_gap SSB frequency layers, while NL1, inter\_with\_gap is the number of SSB frequency layers as indicated in [39-3-1].

For each inter-frequency layer, during each layer 1 measurement period,

* If UE has reported NNeigh\_Cell\_inter in [39-3-2], the UE shall be capable of performing L1-RSRP measurements for at least NNeigh\_Cell neighbor cells.
* If UE has reported Nmax\_SSB\_inter in [39-3-5], the UE shall be capable of performing L1-RSRP measurements for at least Nmax\_SSB SSB resources including serving cell SSBs and neighbour cell SSBs.

### 9.15.5 inter-frequency L1-RSRP with MG

#### 9.15.5.1 Inter-frequency SSB based L1-RSRP Reporting

The requirements specified in this clause are only applicable when

- *highSpeedMeasFlag-r16* is not configured, and

- *highSpeedMeasFlagFR2-r17* is not configured, and

- highSpeedMeasCA-Scell-r17 is not configured, and

- Concurrent gaps are not configured, and

- SSBs of the neighbor cell configured for inter-frequency L1-RSRP measurement are fully or partially overlapped with measurement gaps.

If an inter-frequency neighbor cell is known according to 9.15.2, 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\_Inter if *deriveSSB-IndexFromCellInter-r17* is enabled on target frequency layers or UE is indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) of the same cell. Otherwise, UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB\_inter+TSSB\_time\_index\_inter, where TSSB\_time\_index\_inter is the time period used to acquire the index of the SSB being measured given in Table 9.3.4.

The value of TL1-RSRP\_Measurement\_Period\_SSB\_Inter is defined in Table 9.15.5.1-1 for FR1. The value of TL1-RSRP\_Measurement\_Period\_SSB\_Inter is defined in Table 9.15.5.1-2 for FR2, where

- M= 2

- N = 8.

- CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap in clause 9.1.5.15 for L1-RSRP measurement conducted within measurement gaps.

Table 9.15.5.1-1: Inter-frequency L1-RSRP measurement period TL1-RSRP\_Measurement\_Period\_SSB\_Inter for known cells in FR1

|  |  |
| --- | --- |
| Condition | TL1-RSRP\_Measurement\_Period\_SSB\_Inter |
| No DRX | Max(Treport, Ceil(M \* Kgap) × Max(MGRP, SSB period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(Treport, Ceil(M × 1.5 \* Kgap) × Max(MGRP, SSB period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(M \* Kgap) × DRX cycle × CSSFinter |
| Note 1: The definition of Kgap is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern.  Note 2: If the UE is incapable of [*capability of measurement with RTD>CP*], the requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer. | |

Table 9.15.5.1-2: Inter-frequency L1-RSRP measurement period TL1-RSRP\_Measurement\_Period\_SSB\_Inter for known cells in FR2

|  |  |
| --- | --- |
| Condition | TL1-RSRP\_Measurement\_Period\_SSB\_Inter |
| No DRX | Max(Treport, Ceil(Kgap × M\*N)× Max(MGRP, SSB period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(Treport, Ceil(1.5 \* Kgap × M\*N) × Max(MGRP, SSB period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × M\*N) × DRX cycle × CSSFinter |
| Note 1: The definition of Kgap is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern.  Note 2: If the UE is incapable of [*capability of measurement with RTD>CP*], the requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer. | |

<End of Change #2>

<Start of Change #3>

##### 9.15.6.1.1 Inter-frequency SSB based L1-RSRP measurement

When configured by the network and the inter-frequency cell’s SSB is completely contained in the DL active BWP, the UE shall be able to perform L1-RSRP measurements without gaps and without interruptions 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\_inter\_withoutGap.

If a neighbor cell is known according 9.15.2, 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\_inter\_withoutGap if *deriveSSB-IndexFromCellInter-r17* is enabled or UE has reported SSB index in L3 measurement report of the same cell. Otherwise, UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB\_inter\_withoutGap+TSSB\_time\_index\_inter, where TSSB\_time\_index\_inter is the time period used to acquire the index of the SSB being measured given in Table 9.3.9.1-3 for FR1 and in Table 9.3.9.1-4 for FR2.

The value of TL1-RSRP\_Measurement\_Period\_SSB\_inter\_withoutGap is defined for FR1 in Table 9.15.6.1.1-1. The value of TL1-RSRP\_Measurement\_Period\_SSB\_inter\_withoutGap is defined for FR2 in Table 9.15.6.1.1-2, where

- M=1

- N= 8.

- 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 to be measured 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 to be measured is more than 1

- When none of TCI state(s) of the intra-frequency neighbor cells or inter-frequency neighbor cells without gap are in the active TCI state list

- PL1\_sharing = 3\*NNeighbor\_Cell, where NNeighbor\_Cell is the number of neighbor cells to measure on intra-frequency and inter-frequency without gap

- Otherwise

- PL1\_sharing = 3\*NNeighbor\_Cell\_in\_list, where NNeighbor\_Cell\_in\_list is the number of neigbour cells (including intra-frequency neighbour cell(s) and inter-frequency neighbor cell(s) without gap) whose TCI state(s) are in the active TCI state list. No requirements are defined for any other neighbor cell(s) whose TCI state(s) is not in the active TCI state list.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

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

For either an FR1 or FR2 cell, longer measurement 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 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 9.15.6.1.1-1: Measurement delay for inter frequency L1-RSRP measurement without measurement gaps in FR1 for UE capable of [*capability of measurement with RTD>CP*]

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_inter\_withoutGap (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB\_NBC\*NLayer) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB\_NBC)\*NLayer) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX\*NLayer |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. NLayer = the number of inter-frequency layers which are configured for L1-RSRP measurement with [*LTM-CSI-ResourceConfig-r18*] and measured without measurement gaps + the number of intra-frequency layers configured for L1-RSRP measurement with [*LTM-CSI-ResourceConfig-r18*].  Note 2: K = 1.5. | |

Table 9.15.6.1.1-2: Measurement delay for inter frequency L1-RSRP measurement without measurement gaps in FR2 for UE capable of [capability of measurement with RTD]

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_inter\_withoutGap (ms) |
| non-DRX | max(TReport, ceil(M\*P\*PL1\_sharing\*N)\*TSSB\_NBC) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*PL1\_sharing \*N)\*max(TDRX,TSSB\_NBC) ) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*PL1\_sharing\*N)\*TDRX |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: void.  Note 3: When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of the neighbor cells is in the LTM candidate cell active TCI state list, the requirements apply only to the intra-frequency cells and inter-frequency neighbor cells without gap whose TCI state(s) are in the LTM candidate cell active TCI state list. | |

Table 9.15.6.1.1-3: Measurement delay for inter frequency L1-RSRP measurement without measurement gaps in FR1 for UE incapable of [*capability of measurement with RTD>CP]*

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_inter\_withoutGap (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB\_NBC) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB\_NBC)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency 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 when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer.  Note 4: If in one active BWP, there are more than one LTM L1 measurement frequency layers, the requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement in the same active BWP is not larger than CP length of the cells in the same active BWP. | |

Table 9.15.6.1.1-4: Measurement delay for inter frequency L1-RSRP measurement without measurement gaps in FR2 for UE incapable of [*capability of measurement with RTD>CP]*

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_inter\_withoutGap (ms) |
| non-DRX | max(TReport, ceil(M\*P\*PL1\_sharing\*N)\*TSSB\_NBC) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*PL1\_sharing \*N)\*max(TDRX,TSSB\_NBC) ) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*PL1\_sharing\*N)\*TDRX |
| Note 1: TSSB\_NBC is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: The requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer.  [Note 3: When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of the neighbor cells is in the LTM candidate cell active TCI state list, the requirements only apply to intra-frequency cells and inter-frequency neighbor cells without gap whose TCI state(s) are in the LTM candidate cell active TCI state list.]  Note 4: If in one active BWP, there are more than one LTM L1 measurement frequency layers, the requirements apply when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement in the same active BWP is not larger than CP length of the cells in the same active BWP. | |

<End of Change #3>