**3GPP TSG-RAN WG4 Meeting #** **104-e**

**Electronic Meeting, Aug. 15 – Aug. 26, 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **2477** | **rev** | **1** | **Current version:** | **17.6.0** |  |
|  |
| *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:***  | CR on inter-cell beam managements in R17 feMIMO |
|  |  |
| ***Source to WG:*** | vivo, Intel, Apple |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_feMIMO-Core |  | ***Date:*** | 2022-08-26 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:**Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | 1. CR implementation error is found since 17.5.0.2. The sharing factor is not correct3. Definiton of overlapping SSB between serving cell and cell with different PCI is not captured in L1-RSRP measurements for serving cell and cell with different PCI.  |
|  |  |
| ***Summary of change:*** | 1. Correct CR implementation error2. Correct the sharing factor.3. Added definition of overlapping SSB between serving cell and cell with different PCI based on symbols (SSB index)in SSB occasion.  |
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| ***Consequences if not approved:*** | 1. The CR R4-2207123 is not correctly implemented.2. The agreements are not correctly implemented. |
|  |  |
| ***Clauses affected:*** | 9.5.4, 9.13.4 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.533 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R4-2212668 |

<Start of Change #1>

### 9.5.4 L1-RSRP measurement requirements

#### 9.5.4.1 SSB based L1-RSRP Reporting

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.

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 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

- N= 8 in Table 9.5.4.1-2.

When UE supports concurrent measurement gap and concurrent gaps are configured,

- 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.

Otherwise, for a UE not supporting *concurrentMeasGap-r17* or when concurrent gaps are not 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).

- P is Psharing factor, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC period (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)

- 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.

- If SSB resource from the cell with different PCI is configured for L1-RSRP measurement, and P2 is valid accoding to 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

 *[Editor’s Note: FFS PSC = 1 for HST scenario]*

- 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.

- TSSB = ssb-periodicityServingCell

- TSMTCperiod = the configured SMTC period

- 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.

- When a measurement gap is configured,

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

- xRP = MGRP

- When NCSG 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

- When concurrent 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 9.1.8.

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 pervious conditions.

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 ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | 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 ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | 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 9.5.4.1-3: Measurement period TL1-RSRP\_Measurement\_Period\_SSB configured with [*highSpeedMeasFlagFR2-r17*] for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms)  |
| non-DRX | max(TReport, ceil(M\*P\*N1Note2)\*TSSB) |
| DRX cycle ≤ 80ms | max(TReport, ceil(M\*P\*N1Note2\*M2)\*max(TDRX,TSSB))  |
| 80ms< DRX ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | 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: N1 = 2 when [*highSpeedMeasFlagFR2-r17*] = [set1]; N1 = 6 when [*highSpeedMeasFlagFR2-r17*] = [set2].Note 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 |

<End of Change #1>

<Start of Change #2>

### 9.13.4 L1-RSRP measurement requirements

#### 9.13.4.1 Inter-cell SSB based L1-RSRP Reporting

If a cell with PCI different from serving cell is known according 9.13.2, 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\_CDP.

The value of TL1-RSRP\_Measurement\_Period\_SSB\_CDP is defined in Table 9.13.4.1-1 for FR1, The value of TL1-RSRP\_Measurement\_Period\_SSB\_CDP is defined in Table 9.13.4.1-2 for FR2 when [*highSpeedMeasFlagFR2-r17*] is not configured, where

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

- N= 8.

For FR1,

- P=, when in the monitored cell there are measurement 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 measurement gaps overlapping with any occasion of the SSB.

For FR2,

- P2=, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB\_CDP < TSMTCperiod).

- P2=, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB\_CDP < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB\_CDP < 0.5\*TSMTCperiod

- P2= ,when SSB is partially overlapped with measurement gap (TSSB\_CDP <MGRP) and SSB is partially overlapped with SMTC occasion (TSSB\_CDP < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- If SSB resource from serving cell is configured for L1-RSRP measurements, and P1 is valid accoding to 9.5.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain)

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

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

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

- Otherwise, P = P2Where:

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

- TSMTCperiod = the configured SMTC period

- TSSB\_SC = ssb-periodicityServingCell of the serving cell

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 measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 cell with PCI different from 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 cell with PCI different from 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 9.13.4.1-1: Inter-cell L1-RSRP measurement period TL1-RSRP\_Measurement\_Period\_SSB\_CDP for known cells with different PCIs in FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_CDP (ms)  |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB\_CDP) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB\_CDP)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB\_CDP is the periodicity of the SSB-Index configured for inter-cell L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: [K = 1 when TSSB\_CDP ≤ 40 ms and *highSpeedMeasFlag-r16* are configured; otherwise] K = 1.5.[Note 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]]**[Editor’s Note: Whether inter-cell L1-RSRP measurement requirements are applicable in HST scenario]* |

Table 9.13.4.1-2: Inter-cell L1-RSRP measurement period TL1-RSRP\_Measurement\_Period\_SSB\_CDP for known cells with different PCIs in FR2

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

<End of Change #2>