**3GPP TSG-RAN4 Meeting #111 *R4-2409784***

Fukuoka, Japan, May 20th – 24th, 2024

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** | **4606** | **rev** |  | **Current version:** |  |  |
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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 |  | Radio Access Network |  | Core Network |  |

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| ***Title:*** |  | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
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| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | |  |
|  | *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:*** | | In WF R4-2406439, the agreement is:   * Dynamic collision means when the occasion of Pre-MG with higher priority is involved during the gap collision, where the occasion of other MG/Pre-MG has lower priority.   + With the main bullet, it includes the scenarios for higher priority Pre-MG activation/deactivation procedure colliding with other MG/Pre-MG instance within 4ms. * Further refine the wording for the UE features. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Change 1: add definition of dynamic collision  Change 2: Fix some typo mistakes.  Change 3: add capability condition, and improve the current writing. | | | | | | | | |
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| ***Consequences if not approved:*** | | The spec might not be accurate. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | Clauses 3.1, 8.19.5.1, 8.19.5.2, 8.19.5.3, 9.1.12.4 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

------------------------------ Start of Change 1 ------------------------------

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [11] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [11].

**1 Rx RedCap**: RedCap UE for which requirements are derived assuming 1 Rx branch.

**2 Rx RedCap**: RedCap UE for which requirements are derived assuming 2 Rx branches.

**Active DL BWP**: Active DL bandwidth part as defined in TS 38.213 [3].

**Blackbox Approach:** Testing methodology, in which the UE internal implementation of certain specific UE functionality involved in the test, is unknown.

**CD-SSB:** Cell defining SSB as defined in TS 38.300 [10].

**Control Resource Set:** As defined in TS 38.213 [3].

**DL BWP**: DL bandwidth part as defined in TS 38.213 [3].

**Dynamic collision**: A collision between occasions of two measurement gaps where the higher priority gap is a Pre-MG and the lower priority gap may or may not be a Pre-MG.

**EN-DC**: E-UTRA-NR Dual Connectivity as defined in clause 4.1.2 of TS 37.340 [17].

**en-gNB**: As defined in TS 37.340 [17].

FH: As defined in TS 38.214 [26].

**FR1**: Frequency range 1 as defined in clause 5.1 of TS 38.104 [13].

**FR2**: Frequency range 2 as defined in clause 5.1 of TS 38.104 [13].

**gNB**: as defined in TS 38.300 [10].

**IBM (Independent Beam Management):** As defined in TS 38.101-2 [19].

**IDC solution:** As described in TS 36.300 [24] and TS 38.300 [10].

**LMF**: as defined in TS 38.305 [22].

**Master Cell Group:** As defined in TS 38.331 [2].

**Multi-Radio Dual Connectivity:** Dual Connectivity between E-UTRA and NR nodes, or between two NR nodes, as defined in TS 37.340 [17].

**NCD-SSB:** Non cell defining SSB as defined in TS 38.300 [10].

**ng-eNB**: As defined in TS 38.300 [10].

**NE-DC**: NR-E-UTRA Dual Connectivity as defined in clause 4.1.3.2 of TS 37.340 [17].

**NGEN-DC**: NG-RAN E-UTRA-NR Dual Connectivity as defined in clause 4.1.3.1 of TS 37.340 [17].

**NR-DC**: NR-NR Dual Connectivity as defined in clause 4.1.3.3 of TS 37.340 [17].

**Primary Cell**: As defined in TS 38.331 [2].

**PRS resource instance:** An instance in time of a configured PRS resource as defined in TS 38.331 [2], which may or not overlap with a measurement gap occasion.

**Quasi Co-Location:** As defined in TS 38.214 [26].

**RedCap UE:** A UE with reduced capabilities as defined in clause 4.2 in TS 38.306 [14].

**RLM-RS resource:** A resource out of the set of resources configured for RLM by higher layer parameter RLM-RS-List [2] as defined in TS 38.213 [3].

**SA operation mode**: Operation mode when the UE is configured with at least PCell and not any MR-DC.

**Secondary Cell**: As defined in TS 38.331 [2].

**Secondary Cell Group:** As defined in TS 38.331 [2].

**Serving Cell**: As defined in TS 38.331 [2].

**SMTC**: An SSB-based measurement timing configuration configured by *SSB-MeasurementTimingConfiguration* as specified in TS 38.331 [2].

**Special Cell:** As defined in TS 38.331 [2].

**SSB:** SS/PBCH block as defined in clause 7.8.3 of TS 38.211 [6].

**Timing Advance Group**: As defined in TS 38.331 [2].

----------------------------- End of Change 1 -----------------------------

------------------------------ Start of Change 2 ------------------------------

### 8.19.5 Activation/deactivation delay requirements for concurrent measurement gaps with Pre-MG

The requirements in this clause apply to a UE configured with concurrent measurement gaps with Pre-MG.

#### 8.19.5.1 Activation/deactivation delay requirements for non-overlapped activation/deactivation of concurrent measurement gaps with Pre-MGs

The requirements in this clause only apply when the activation/deactivation procedures of the individual pre-configured measurement gaps do not overlap in time.

When concurrent measurement gaps with Pre-MG activation/deactivation procedure are non-overlapped upon DCI/timer-based BWP switch, upon SCell activation/deactivation or upon RRC reconfiguration, for each individual pre-configured measurement gap, the requirements defined in clauses 8.19.2, 8.19.3 and 8.19.4 apply.

#### 8.19.5.2 Activation/deactivation delay requirements for fully overlapped activation/deactivation of concurrent measurement gaps with Pre-MGs

The requirements in this clause only apply when the activation/deactivation procedures of the individual pre-configured measurement gaps fully overlap in time.

Fully overlapped activation/deactivation of pre-configured measurement gaps can occur in the following cases:

- Both pre-configured measurement gaps are triggered by the same event.

- Two pre-configured measurement gaps are triggered by two events of the same type at the same time.

When concurrent measurement gaps with Pre-MG are activated/deactivated simultaneously, the activation/deactivation delay requirements are defined in clauses 8.19.2, 8.19.3 and 8.19.4 for activation/deactivation triggered by DCI/timer-based BWP switch, SCell activation/deactivation or RRC reconfiguration, respectively, plus an additional 2ms post-processing time.

#### 8.19.5.3 Pre-configured measurement gap activation/deactivation delay when colliding with a concurrent measurement gap

When the activation/deactivation procedure of a pre-configured measurement gap collides with a concurrent measurement gap occasion, the requirements defined in clause 9.1.12.4 apply.

----------------------------- End of Change 2 -----------------------------

------------------------------ Start of Change 3 ------------------------------

#### 9.1.12.2 Requirements

If the UE requires measurement gaps and/or Pre-MGs to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports [ConMGs with Pre-MG] but does not support independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply, the network can provide the UE with not more than two per-UE measurement gap patterns for monitoring all the frequency layers.

If the UE supports both [ConMGs with Pre-MG] and independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements defined for concurrent measurement gaps with Pre-MG to apply, the network can provide the measurement gap patterns’ combinations specified in Table 9.1.12.1 for monitoring of all frequency layers.

Table 9.1.12-1: The number of Gap Combination Configurations by UE supporting both concurrentMeasGapsPreMG-r18 and independent measurement gap patterns

|  |  |  |  |
| --- | --- | --- | --- |
| Gap Combination  Configuration Id | The number of simultaneous configured measurement gap patterns | | |
| Per-FR1 measurement gap | Per-FR2 measurement gap | Per-UE measurement gap |
| 0 | 2 | 1 | 0 |
| 1 | 1 | 2 | 0 |
| 2 | 0 | 0 | 2 |
| 3Note 1 | 1 | 0 | 1 |
| 4Note 1 | 0 | 1 | 1 |
| 5Note 1 | 1 | 1 | 1 |
| 6 | 2 | 0 | 0 |
| 7 | 0 | 2 | 0 |
| Note 1: Gap Combination Configuration Id #3, #4, #5 are only applicable when the per-UE measurement gap is associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference measurement and PRS-RSRPP measurement defined in TS 38.215 [4].  [Note 2]: For UE capable of [Concurrent Pre-MG], up to 2 measurement gap patterns can be configured as Pre-MG in one FR, regardless of whether they are per-UE or per-FR configuration. Otherwise, the gaps can only be configured as Gap(s) configured via *GapConfig* without suffix or Gap(s) configured via *GapConfig-r17* without *preConfigInd-r17* or *ncsgInd-r17*.  Note 3: In Gap Combination Configuration Id #0, #1, #6, #7, one per-FR measurement gap in an FR can be associated to measure PRS for any RSTD, PRS-RSRP, PRS-RSRPP, RSCP, RSCPD and UE Rx-Tx time difference measurement defined in TS 38.215 [4] provided that UE supports *independentGapConfigPRS-r17*. | | | |

When the UE supports concurrentMeasGapsPreMG-r18, the gap association for a frequency layer is configured by the network via *associatedMeasGapSSB-r17* or *associatedMeasGapCSIRS-r17*  in the corresponding MO(s). In this case the gap association rules in clause 9.1.8.2 shall also apply to either measurement gap or Pre-MG.

When autonomous mechanism [1] is used for activation/deactivation of Pre-MG pattern, the UE shall autonomously determine the Pre-MG status only based on the measurement objects associated with the concerned Pre-MG. The related Pre-MG autonomous activation/deactivation mechanism is specified in clause 9.1.7.3.1.

When network-controlled mechanism [1] is used for activation/deactivation, the requirements specified in clause 9.1.7.3.2 apply.

When UE supports concurrentMeasGapsPreMG-r18, where at least one of the concurrent gaps is Pre-MG, applicable measurement gap patterns are listed in Table 9.1.2-1, and their applicability based on measurement and serving cell configurations is specified in table 9.1.2-3.

The requirements in clause 9.1.2 are applicable for the UE capable of concurrentMeasGapsPreMG-r18 and configured with multiple concurrent measurement gap patterns within each activated Pre-MG pattern.

#### 9.1.12.3 Collisions involving Pre-MG(s)

Collisions between a Pre-MG and a measurement gap may occur only when the Pre-MG is activated. No collisions can occur between a per-FR Pre-MG and a per-FR measurement gap when they are configured in different FRs.

Collisions between two Pre-MGs may occur only when both Pre-MGs are activated and satisfy the collision rule defined in clause 9.1.8.3. No collisions can occur between per-FR Pre-MGs when they are configured in different FRs.

The requirements for concurrentMeasGapsPreMG-r18 apply provided that the two measurement gaps(at least one of the gaps is activated Pre-MG) colliding with each other are configured with different priorities.

If a UE does not support [dynamic collisions capability], UE behavior is undefined if such collisions occur for a given concurrent measurement gap configuration including at least one Pre-MG.

----------------------------- End of Change 3 -----------------------------

------------------------------ Start of Change 4 ------------------------------

#### 9.1.12.4 Collision between Pre-MG activation/deactivation and measurement gap

A measurement gap occasion and a Pre-MG activation/deactivation procedure collide when the ending point of the Pre-MG activation/deactivation procedure occurs anywhere within a time period starting 4ms before the starting point of the gap occasion and ending 4ms after the ending point of the gap occasion. The ending point of the Pre-MG activation/deactivation procedure is defined in clause 8.19.5.3.If the UE supports [dynamic collision capability], then:

* When a collision occurs between a measurement gap occasion and a Pre-MG activation procedure, and the Pre-MG is configured with higher priority, the UE shall perform measurements during the measurement gap occasion and the activation of the Pre-MG is delayed until 5ms after the ending point of the measurement gap occasion.
* When a collision occurs between a measurement gap occasion and a Pre-MG deactivation procedure, and the Pre-MG is configured with higher priority, the measurement gap occasion shall be (or remain) dropped if the measurement gap occasion collides with an occasion of the Pre-MG.

When the activated Pre-MG and measurement gap satisfy the collision rule defined in clause 9.1.8.3 and the Pre-MG is configured with lower priority, the UE shall perform measurements in the occasion of the measurement gap regardless of whether it collides with the Pre-MG activation procedure or collides with the Pre-MG deactivation procedure.

The UE shall transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI in the corresponding NR serving cells in the slots of the configured Pre-MG that are dropped according to the requirements in clause 9.1.8.4.

----------------------------- End of Change 4 -----------------------------

------------------------------ Start of Change 5 ------------------------------

9.1.13.2 Requirements

If the UE requires measurement gaps and/or NCSG to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports [*concurrentNCSGPerUE-OnlyMeasGapwithNCSG-r18*] but does not support independent measurement gap patterns for different frequency ranges as specified in [14], in order for the requirements in the following clauses to apply, the network can provide one per-UE measurement gap and one per-UE NCSG or at most two per-UE NCSGs for monitoring of all frequency layers.

If the UE requires measurement gaps and/or NCSG to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports[*concurrentNCSGPerUE-PerFRCombMeasGapwithNCSG-r18*] as specified in [14], in order for the requirements defined for concurrent measurement gaps with NCSG to apply, the network can provide the measurement gap with NCSG pattern combinations specified in Table 9.1.13-1 for monitoring of all frequency layers.

**Table 9.1.13-1: The number of Gap Combination Configurations by UE supporting both concurrent measurement gap with NCSG patterns, per-FR NCSG patterns and independent measurement gap patterns**

|  |  |  |  |
| --- | --- | --- | --- |
| **Gap Combination**  **Configuration Id** | **The number of simultaneous configured measurement gap patterns** | | |
| **Per-FR1 [measurement gap]** | **Per-FR2 [measurement gap]** | **Per-UE [measurement gap]** |
| 0 | 2 | 1 | 0 |
| 1 | 1 | 2 | 0 |
| 2 | 0 | 0 | 2 |
| 3Note 1 | 1 | 0 | 1 |
| 4Note 1 | 0 | 1 | 1 |
| 5Note 1 | 1 | 1 | 1 |
| 6 | 2 | 0 | 0 |
| 7 | 0 | 2 | 0 |
| Note 1: Gap Combination Configuration Id #3, #4, #5 will be only applied when the per-UE measurement gap with NCSG is concurrent MG (and cannot be NCSG) is associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP measurement defined in TS 38.215 [4], and when the per-FR measurement gap with NCSG in an FR is NCSG.  [Note 2: In Gap Combination Configuration Id #0, #1, #6, #7, one per-FR measurement gap in an FR (and cannot be NCSG) can be associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP measurement defined in TS 38.215 [4] provided that UE supports *independentGapConfigPRS-r17*.]  Note 3: In Gap Combination Configuration Id #0, #1, #2, #6, #7, one FR can be configured with up to 2 NCSGs, regardless they are per-UE or per-FR configured. Otherwise, the gaps can only be configured as Gap(s) configured via *GapConfig* without suffix or Gap(s) configured via *GapConfig-r17* without *preConfigInd-r17* or *ncsgInd-r17*. | | | |

For UE configured in the SA operation mode, when monitoring of multiple inter-RAT E-UTRAN carrier frequency layers and inter-frequency NR carrier frequency layers as configured by PCell using gaps, each monitored carrier frequency layer, including following measurement types:

- a measurement object with SSB based measurement,

- a measurement object with CSI-RS based measurement,

- E-UTRA inter-RAT measurement object,

can be associated to either one measurement gap pattern or one NCSG pattern, while the following measurement types:

- E-UTRAN inter-RAT RSTD measurement,

- NR PRS-based positioning measurements,

can be only associated to one measurement gap pattern. Requirements for [concurrent measurement gaps with NCSG] apply provided that each frequency layer is only associated with one concurrent measurement gap or one NCSG, and at least one of the gaps is NCSG. There can be one or more frequency layers associated with each concurrent measurement gap or each NCSG. [Furthermore, if the UE is not capable of [concurrentMeasGapEUTRA-r17][2], all E-UTRAN measurement objects shall be associated with a single measurement gap or NCSG for the requirement to apply.]

When UE supports concurrent measurement gap with NCSG , where at least one of the concurrent gaps is NCSG, supported measurement gap patterns are listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-3, while supported NCSG patterns are listed in Table 9.1.9.3-1 based on the applicability specified in table 9.1.9.3-2.

The requirements in clause 9.1.2 are also applicable for the UE capable of and configured with multiple [concurrent measurement gap with NCSG] patterns within one measurement gap pattern. The requirements in clause 9.1.9 are also applicable for the UE capable of and configured with multiple [concurrent measurement gap with NCSG] patterns within each NCSG pattern.

----------------------------- End of Change 5 -----------------------------