**3GPP TSG-RAN4 Meeting #** **111R4-2410436**

[Fukuoka City,](https://www.3gpp.org/Specification-Groups/) Japan, 20 May – 24 May, 2024

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **4612** | **rev** | **-** | **Current version:** | **18.5.0** |  |
|  |
| *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:***  | Big CR on Core maintenance for NR Dual TxRx Multi-SIM |
|  |  |
| ***Source to WG:*** | vivo  |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_DualTxRx\_MUSIM-Core |  | ***Date:*** | 2024-05-27 |
|  |  |  |  |  |
| ***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 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-17 (Release 17)Rel-18 (Release 19)Rel-19 (Release 19)Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | This Big CR is to capture contents for core part maintenance in endorsed draft CRs in the RAN4#110bis and RAN4#111 meeting. |
|  |  |
| ***Summary of change:*** | The following endorsed CRs are captured in this Big CR.RAN4#110bisR4-2404495 Draft CR for Carrier-specific scaling factor for Rel-18 MUSIM, vivoRAN4#111R4-2408709 Draft CR for applicable conditions for intra or inter-frequency measurement when MUSIM is configured, vivoR4-2410426 draftCR on RRM requirements for MUSIM gaps, Huawei, HiSilicon, vivo, ZTE, MediaTek, Nokia, Nokia Shanghai Bell, Ericsson, Qualcomm |
|  |  |
| ***Consequences if not approved:*** | RRM requirements for Dual Tx/Rx Multi-SIM for NR in Rel-18 is not complete. |
|  |  |
| ***Clauses affected:*** | 3.6.17, 9.1.5.2; 9.2.1; 9.3.1; 9.1.10 |
|  |  |
|  | **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:*** |  |

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### 3.6.17 Applicability of requirements for MUSIM gaps

No requirements are defined in this version of specification when MUSIM gaps collide with Pre-MG and/or NCSG.

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#### 9.1.5.2 Monitoring of multiple layers within gaps

For a UE supporting concurrent gaps or [concurrent gaps with Pre-MG] or [concurrent gaps with NCSG], and when concurrent gaps are configured the carrier-specific scaling factor CSSFwithin\_gap,i for a measurement object *i* derived in this chapter is applied to following measurement types for the associated measurement gap:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2.5 and 9.2A.5, when

- all of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in concurrent [GAPs], or

- part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent [GAPs].

- part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent [GAPs] or with the union of concurrent concurrent [GAPs] and MUSIM gaps if MUSIM gaps are configured.

- SSB-based intra-frequency measurement object with measurement gap in clause 9.2.6 and 9.2A.6.

…

Otherwise, the carrier-specific scaling factor CSSFwithin\_gap,i for a measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2.5 and 9.2A.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2.5 and 9.2A.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap or the union of measurement gaps and MUSIM gaps.

- SSB-based intra-frequency measurement object with measurement gap in clause 9.2.6 and 9.2A.6.

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### 9.2.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the SSB of the serving cell indicated for measurement 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.

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

*…*

The intra-frequency measurement requirements in clause 9.2.5 applies for the following scenarios:

- SSB based intra-frequency measurements with no measurement gap,

- for a UE supporting concurrent gaps and when concurrent gaps are configured:

- When none of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.

- When part of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.

 - for a UE supporting MUSIM gaps or both concurrent measurement gaps and MUSIM gaps, and when periodic MUSIM gaps or both concurrent and periodic MUSIM gaps are configured:

 - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps or the union of MUSIM gaps and concurrent measurement gaps.

- When part of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps or the union of MUSIM gaps and concurrent measurement gaps.

 - for a UE supporting MUSIM gaps and not supporting concurrent gaps or if concurrent gaps are not configured, and when periodic MUSIM gaps are configured:

 - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the measurement gap or the union of MUSIM gaps and measurement gap.

- When part of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the measurement gap or the union of MUSIM gaps and measurement gap.

- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:

…

The intra-frequency measurement requirements in clause 9.2.6 applies for the following scenarios:

- SSB based intra-frequency measurements with measurement gap,

- SSB based intra-frequency measurements with no measurement gap with the following condition,

- for a UE supporting concurrent gaps and when concurrent gaps are configured:

- when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in the concurrent measurement gaps, or

- when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent measurement gaps.

 - for a UE supporting concurrent measurement gaps and when both concurrent and periodic MUSIM gaps are configured

- when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in concurrent measurement gaps and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent measurement gaps and MUSIM gaps. No requirement applies if no concurrent measurement gap is assocated with that SSB based intra-frequency measurements.

- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:

- when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the measurement gap.

- when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of the measurement gap and MUSIM gaps if MUSIM gaps are configured.

- SSB-based intra-frequency measurement object with NCSG, and measurement gap is configured.

…

The intra-frequency measurement requirements in clause 9.2.7 applies for the following scenarios:

* SSB based intra-frequency measurements without measurement gaps corresponding to an activated serving cell, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;
* SSB-based intra-frequency measurement object corresponding to an activated serving cell (in non-dormancy) when UE supports nr-NeedForGapNCSG-reporting-r17 and indicates ‘ncsg’ in NeedForGapNCSG-InfoNR for intra-frequency measurement and all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based intra-frequency measurement object corresponding to a deactivated serving cell or to an activated serving cell in dormancy when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG.

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whehter interruptions are allowed.

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### 9.3.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell or PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

…

The inter-frequency measurement requirements in clause 9.3.4 and clause 9.3.5 applies for the following scenarios:

- SSB-based inter-frequency measurement object with measurement gap.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap*, when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or associated measurement gap in concurrent measurement gaps and the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent measurement gaps or the union of concurrent measurement gaps and MUSIM gaps if MUSIM gaps are configured.

- no requirement applies if all of the SMTC occasions of this inter-frequency measurement object are overlapped with MUSIM gaps if MUSIM gaps are configured.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of [*NeedForInterruptionInfoNR-r18*], when

…

The inter-frequency measurement requirements in clause 9.3.9 applies for the following scenarios:

- SSB-based inter-frequency measurement with no measurement gap, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- for UE indicating [*NeedForInterruptionInfoNR-r18*], when

- none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps for the UE indicates ‘no-gap’ via *NeedForGapsInfoNR* and [no-gap-with-interruption] or [no-gap-no-interruption] via *NeedForInterruptionInfoNR* for the inter-frequency measurement.

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, for the UE indicates ‘no-gap’ via *NeedForGapsInfoNR* and [no-gap-no-interruption] via *NeedForInterruptionInfoNR* for the inter-frequency measurement.

- none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, for the UE indicates ‘no-gap’ via *NeedForGap-InfoNR* for the inter-frequency measurement and [no-gap-with-interruption] or [no-gap-no-interruption].

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, for the UE indicates ‘no-gap’ via *NeedForGap-InfoNR* for the inter-frequency measurement.

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### 9.1.10 MUSIM gaps

If the UE requires gap patterns for MUSIM purpose, such as cell identification and measurement, paging monitoring, SIB acquisition, and/or on-demand SI request of the target cell in the target network, then the network may provide one or more per-UE MUSIM gap pattern(s) for concurrent monitoring of all frequency layers for MUSIM via *MUSIM-GapConfig* [2]. The UE can be configured with no more than three periodic MUSIM gap patterns and/or one aperiodic MUSIM gap pattern for MUSIM via *MUSIM-GapConfig* [2]. The MUSIM gap patterns specified in Table 9.1.10-1 are applicable only for MUSIM operation.

The UE is not required to perform cell identification and measurement, paging monitoring, SIB acquisition, and/or on-demand SI request of the target cell in the target network that is outside the MUSIM gaps.

The UE is not required to conduct reception or transmission from or to the [source] network during MUSIM gaps that are not dropped due to collisions, as defined in clauses 9.1.10.4 and 9.1.10.5.

UE supporting MUSIM capability shall support the MUSIM gap patterns listed in Table 9.1.10-1 based on UE’s capability specified in TS38.306[14] and the applicability specified in Table 9.1.10-2.

UE determines MUSIM gap timing based on gap offset configuration from serving cell provided by higher layer signalling as specified in TS 38.331 [2].

Table 9.1.10-1: MUSIM Gap Pattern Configurations

|  |  |  |
| --- | --- | --- |
| **MUSIM Gap Pattern Id** | **MUSIM Gap Length (MGL, ms)** | MUSIM Gap Repetition Period (MGRP, ms) |
| 0 | 6 | 40 |
| 1 | 6 | 80 |
| 2 | 3 | 40 |
| 3 | 3 | 80 |
| 4 | 6 | 20 |
| 5 | 6 | 160 |
| 6 | 4 | 20 |
| 7 | 4 | 40 |
| 8 | 4 | 80 |
| 9 | 4 | 160 |
| 10 | 3 | 20 |
| 11 | 3 | 160 |
| 12 | 10 | 80 |
| 13 | 20 | 160 |
| 14 | 6 | 320 |
| 15 | 6 | 640 |
| 16 | 6 | 1280 |
| 17 | 6 | 2560 |
| 18 | 10 | 320 |
| 19 | 10 | 640 |
| 20 | 10 | 1280 |
| 21 | 10 | 2560 |
| 22 | 20 | 320 |
| 23 | 20 | 640 |
| 24 | 20 | 1280 |
| 25 | 20 | 2560 |
| 26 | 20 | 5120 |
| 27 | 10 | NA |
| 28 | 20 | NA |
| Note 1: Measurement gap pattern #27, #28 are the aperiodic gap pattern without MGRP. |

Table 9.1.10-2: Applicability for MUSIM Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier, NR CA configuration)

|  |  |  |  |
| --- | --- | --- | --- |
| MUSIM gap pattern configuration | Serving cell  | Gap Purpose | Applicable MUSIM Gap Pattern Id |
| Per-UE  | FR1, FR2, or | MUSIM Note1  | 0-13, 14-26, 27, 28 |
| MUSIM gap | FR1 + FR2 |
|  |  |
| NOTE 1: Inclusion of MUSIM procedures for per-UE MUSIM gaps only in NR single carrier, NR CA mode: MUSIM purpose which includes cell identification and measurement, paging monitoring, SIB acquisition, and/or on-demand SI request of the target cell in the target network. |

#### 9.1.10.1 Introduction

This clause contains the requirements on the UE supporting MUSIM capability, requirements in this section are applicable for UE in NR SA (including CA) operation mode.

#### 9.1.10.2 Priorities for MUSIM gaps

Priority levels are applied for each periodic MUSIM gap. A UE shall request a priority for all requested periodic MUSIM gaps when the UE requests MUSIM gaps via MUSIM-GapConfig-r17 [2]. The UE shall request different priority level for each periodic MUSIM gaps. The network may assign priority to each periodic MUSIM gaps. The allocated priorities may differ from the priorites requested by the UE. The UE MUSIM requirements apply if the configured MUSIM gap priorities retain the same relative priorities among MUSIM gaps as requested by the UE.

The requirements in clause 9.1.10 apply provided different priority levels are allocated to each periodic MUSIM gaps and different priority levels are allocated to each periodic MUSIM gap and each measurement gap configured via GapConfig-r17 without preConfigInd-r17 or ncsgInd-r17.

An aperiodic MUSIM gap, when configured, is unconditionally kept in case of collisions with any other gap occasions, including MUSIM gaps and measurement gaps.

#### 9.1.10.3 Keep solution for MUSIM gaps

The UE can request use of “keep solution” via *musim-GapKeepPreference* in [2]. Keep solution is for handling collisions among different MUSIM gaps. If the use of “keep solution” is granted, the UE shall keep all colliding periodic and aperiodic MUSIM gaps irrespectively of the priority of the periodic MUSIM gaps.

#### 9.1.10.4 Collisions between different MUSIM gaps

MUSIM gap occasions are considered colliding if at least one of the following conditions is met:

- the MUSIM gap occasions are fully overlapping in time domain, or

- the MUSIM gap occasions partially overlapping in time domain, or

- the distance between the two MUSIM gap occasions is equal to or smaller than 4ms.

When “keep solution” in clause 9.1.10.3 is not used, a periodic MUSIM gap occasion colliding with an aperiodic MUSIM gap is dropped.

When “keep solution” in 9.1.10.3 is not used, collisions between periodic MUSIM gap occasions are resolved based on the assigned MUSIM gap priorities. Collisions are resolved sequentially in order of decreasing priority, starting with the gap that has the highest priority. For each collision, the occasion of the MUSIM gap with highest priority shall be kept and the occasion of the MUSIM gap with lower priority shall be dropped.

#### 9.1.10.5 Collisions between MUSIM gaps and measurement gaps

MUSIM gap and measurement gap occasions are considered colliding if at least one of the following conditions is met:

- the MUSIM gap and measurement gap occasions are fully overlapping in time domain, or

- the MUSIM gap and measurement gap occasions are partially overlapping in time domain, or

- the distance between any of the MUSM gap and the measurement gap occasions is equal to or smaller than 4ms.

The distance between two gap occasions is defined as the time difference between the ending point of the first occasion and the starting point of the second occasion, where the first gap occasion occurs earlier in time than the second gap occasion. The gap occasion can be either a MUSIM gap occasion or a measurement gap occasion.

The measurement gap occasion colliding with an aperiodic MUSIM gap is dropped.

Collisions between MUSIM gaps and measurement gaps configured via GapConfig-r17 with assigned priority but without preConfigInd-r17 or ncsgInd-r17 are handled based on their assigned priorities. Collisions are resolved sequentially in order of decreasing priority, starting with the gap that has the highest priority. For each collision, the occasion of the MUSIM gap or measurement gap with highest priority shall be kept and the occasion of the MUSIM gap or measurement gap with lower priority shall be dropped. Any collisions between MUSIM gaps shall be addressed as specified in clause 9.1.10.3 and 9.1.10.4. When “keep solution” in clause 9.1.10.3 is configured, keep solution is used for the remaining collided and non-dropped MUSIM gaps, after resolving the collisions between measurement gaps and MUSIM gaps based on their priorities.

Collisions between MUSIM gaps and measurement gaps configured via GapConfig or configured via GapConfig-r17 without assigned priority are handled based on MGRP of the colliding gaps. Collisions are resolved sequentially in order of decreasing MGRP, starting with the gap that has the longest MGRP. For each collision, the occasion of the MUSIM gap or measurement gap with longer MGRP shall be kept and the occasion of the MUSIM gap or measurement gap with shorter MGRP shall be dropped. If the colliding MUSIM gap and measurement gap have the same MGRP, the requirements in clause 9 shall not apply. Any collisions between MUSIM gaps shall be addressed as specified in clause 9.1.10.3 and 9.1.10.4. When “keep solution” in clause 9.1.10.3 is configured, keep solution is used for the remaining collided and non-dropped MUSIM gaps, after resolving the collisions between measurement gaps and MUSIM gaps based on their MGRP.

#### 9.1.10.6 MUSIM gap related requirements

A slot is interrupted by a MUSIM gap if it overlaps with any occasion of the configured MUSIM gap, except for a dropped MUSIM gap occasion.

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