**3GPP TSG-RAN4 Meeting #111 *R4-2410145***

**Fukuoka, Japan, 20 – 24 May, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** | 1 | **Current version:** |  |  |
|  | | | | | | | | |
| *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:*** | draftCR on RRM requirements for MUSIM gaps | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon, vivo, ZTE, MediaTek | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_DualTxRx\_MUSIM-Core | | | | |  | ***Date:*** | | | 2024-04-23 |
|  |  | | | |  | |  | | |  |
| ***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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | There are some ambigguity with collison handling requirements.   1. It is unclear how aperiodic MUSIM gap handled in collision with MG, or with periodic MUSIM gaps when keep solution is not used. 2. In 9.1.10.5, it is specified that “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”. However, dropping of MUSIM gap is not applicable when keep solution is used. 3. In R4-2403352, the changes are only made for collision between MUSIM gap and Type-2 MG. Same changes are needede for Type-1 MG. 4. Interruption requirements for MUSIM gaps are unclear. 5. Collision between MUSIM gap and pre-MG should account for both activated and deactivated pre-MG. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Update collison handling requirements for above issues:   1. Clarify aperiodic MUSIM gap is assumed with higher priority or longer MGRP than MG or periodic MUSIM gaps. 2. In 9.1.10.5, split separate requirements for two cases with keep solution used and not used. 3. Update requirements for collision between MUSIM gap and Type-1 MG to align with Type-2 MG. 4. Capturing that UE is schedulable within dropped gaps. 5. Remove “activated” in 3.6.17. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Collison handling requirements are unclear and incomplete. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.6.17, 9.1.10 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start of Change 1>

### 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.

<End of Change 1>

<Start of Change 2>

### 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 the MUSIM gaps, which are not dropped due to collision, 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 used, a periodic MUSIM gap occasion colliding with an aperiodic MUSIM gap is kept provided that the periodic MUSIM gap is not colliding with any non-dropped occasion of a measurement gap with higher priority at the same time.

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. The periodic MUSIM gap occasion colliding with an aperiodic MUSIM gap is 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.

<End of Change 2>