**3GPP TSG-RAN WG4 Meeting # 104-e R4-2212031**

**Electronic Meeting, August 15 – August 26, 2022**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **2443** | **rev** |  | **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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | CR to enhanced gap configuration for RRM requirements applicability | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | OPPO | | | | | | | | | |
| ***Source to TSG:*** | RAN4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MG\_enh-Core | | | | |  | | ***Date:*** | | 2022-08-10 |
|  |  | | | |  | | |  | |  |
| ***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 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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | R4-2210624 replies that no requirement for joint configuration of different gap features in Rel-17 will be defined in RAN4 while the signalling designed in RAN2 spec allows all possible gap combinations. Such restrictions on gap configurations should be explicitly captured in RAN4 spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | For RRM requirements applicability for pre-configured gap, concurrent gap and NSCS, gap combinations for different gap enhancement features are excluded. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The existing RRM requirements may incorrectly apply for the scenarios when gap combinations for different gap features are configured by the network. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 9.1.7.2 & 9.1.8.2 & 9.1.9.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | |  | | | |
| ***Other specs*** | |  | **X** | Other core specifications | | |  | | | |
| ***affected:*** | | **X** |  | Test specifications | | | TS 38.533 | | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | |  | | | |
| ***Other comments:*** | |  | | | | | | | | |

**< Start of change 1>**

### 9.1.7 Pre-configured measurement gap

#### 9.1.7.1 Introduction

A UE capable of Pre-configured measurement gap (Pre-MG) pattern can be configured with a Pre-MG pattern via RRC signalling [2].

The gap interruption requirements in Section 9.1.2 apply to Pre-MG when Pre-MG is activated, and no gap interruption is expected when Pre-MG is deactivated.

- The requirements apply for NR standalone operation with single carrier and NR CA.

#### 9.1.7.2 Requirements applicability

The requirements related to pre-configured measurement gap apply provided:

- UE indicates support of *preconfiguredUE-AutonomousMeasGap* [2] and/or *preconfiguredNW-ControlledMeasGap* [2], and

* either a single per-UE measurement gap is pre-configured by the network and no other “gap” is configured, one or two per-FR measurement gaps are pre-configured by the network and no other per-UE “gap” is configured or no other per-FR “gap” is configured in the same FR, where the other “gap” including
  + gap patterns #0 ~ #25 defined in Table 9.1.2-1,
  + NCSG patterns defined in Clause 9.1.9,
  + MUSIM gap patterns defined in Clause 9.1.10,
  + Measurement gaps associated with NTN defined in Clause 9.1C.2,
  + pre-configured Pos gap via *posMeasGapPreConfig*,

- one of measurement gap patterns among measurement gap patterns #0 ~ #25 defined in Table 9.1.2-1 is configured for pre-configured measurement gap, and

- UE is in NR SA with single carrier or with NR CA.

A measurement gap is configured as pre-configured measurement gap if *preConfigInd* is indicated by network in the configuration message of the measurement gap.

If both *preConfigInd* and *nscgInd* are indicated by network for measurement gap, the measurement requirements do not apply.

If UE indicates support of only *preconfiguredNW-ControlledMeasGap* [2], UE can expect the network to configure [*RAN2 signaling design for per BWP status indication*].

*Editor’s note: In current RAN2 spec, there is no explicit signaling from network to indicate which activation/deactivation mechanism is chosen by network. RAN2 may resolve this issue later.*

If a measurement gap is configured as pre-configured measurement gap, the applicability of measurement gap patterns is defined in Table 9.1.2-3.

A pre-configured measurement gap may not be sufficient to perform PRS measurements because it is not always activated as determined from the signalling provided by the network or from the autonomous rules to determine the status of the pre-configured measurement gap. In this scenario, the UE will inform the network that it is going to start/stop PRS measurements with the configured pre-configured measurement gap by initiating the existing *LocationMeasurementIndication* procedure.

If the Pre-MG status changes during a measurement period of a measurement that can be performed without and within measurement gaps, the UE is allowed to restart the measurement.

If the Pre-MG status changes from activated to deactivated during a measurement period of a measurement that can only be performed within measurement gaps, the measurement requirements do not apply.

**< End of change 1>**

**< Start of change 2>**

### 9.1.8 Concurrent measurement gaps

#### 9.1.8.1 Introduction

When UE supports concurrent measurement gap pattern capability, network can provide multiple measurement gaps configured by RRC message(s) as specified in TS 38.331 [2]. Requirements in this section applies when the UE is in SA operation mode.

#### 9.1.8.2 Requirements

The requirements related to concurrent measurement gap apply provided:

* UE indicates support of concurrent gap patterns, and
* The measurement gap combinations specified in Table 9.1.8-1 are configured by the network, and
* each concurrent measurement gap can only be configured as the gap patterns #0 ~ #25 defined in Table 9.1.2-1,
  + *preConfigInd* should not be indicated in the configuration message of each measurement gap,
  + *ncsgInd* should not be indicated in the configuration message of each measurement gap,
  + MUSIM gap patterns defined in Table 9.1.10-1 should not be configured via *MUSIM-GapConfig*,
  + pre-configured Pos gap via *posMeasGapPreConfig* should not be configured,

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports concurrent measurement gap patterns 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 at most two per-UE measurement gap patterns for monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports both concurrent measurement gap patterns 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 to apply the network can provide the following measurement gap patterns’combinations for monitoring of all frequency layers. The supported measurement gap combination configurations for UE supporting both concurrent measurement gap patterns and independent measurement gap patterns for different frequency ranges are specified in Table 9.1.8-1.

Table 9.1.8-1: The number of Gap Combination Configurations by UE supporting both concurrent measurement gap 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 is associated to measure PRS for any RSTD, PRS-RSRP, and UE Rx-Tx time difference measurement defined in TS 38.215 [4]. | | | |

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,

- E-UTRAN inter-RAT RSTD measurement,

- NR PRS-based measurements,

can be only associated to one measurement gap pattern. Requirements for concurrent measurement gaps apply provided that each frequency layer is only associated with one concurrent measurement gap. There can be one or more frequency layers associated with each concurrent measurement gap.

When UE supports concurrent measurement gap patterns, each measurement gap pattern supported by the UE is listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-2 and 9.1.2-3.

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

**< End of change 2>**

**< Start of change 3>**

### 9.1.9 Network controlled small gap

#### 9.1.9.1 Introduction

The UE capable of network controlled small gap (NCGG) pattern can be configured with a NCSG pattern via RRC signalling [2].

This clause contains the general requirements on the UE regarding to Network Controlled Small Gap (NCSG).

The requirements in this clause are applicable provided:

* UE indicates support of NCSG, and
* either a single per-UE NCSG is configured by the network and no other “gap” is configured, or one or two per-FR NCSGs are pre-configured by the network and no other per-UE “gap” is configured or no other per-UE “gap” is configured in the same FR, where the other “gap” including
  + gap patterns #0 ~ #25 defined in Table 9.1.2-1,
  + pre-configured patterns defined in Clause 9.1.7,
  + MUSIM gap patterns defined in Clause 9.1.10,
  + Measurement gaps associated with NTN defined in Clause 9.1C.2,
  + pre-configured Pos gap via *posMeasGapPreConfig*,
* at least one of NCSG patterns #0 ~ #23 defined in Table 9.1.9.3-1 is configured, and
* UE is configured with SA NRoperation mode.

A measurement gap is configured as NCSG if *ncsgInd* is indicated by network in the configuration message of the measurement gap.

If both *nscgInd* and *preConfigInd* are indicated by network for measurement gap, the measurement requirements do not apply.

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when [NCSGTA] is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the last each of the interrupted slots after VIL1 and VIL2.

- when [NCSGTA] is applied and the SCS of the UL carrier is other than 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the last each of the interrupted slots after VIL1 and VIL2.

- when [NCSGTA] is applied and the SCS of the UL carrier is 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with each of the interrupted slots after VIL1 and VIL2.

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if  for the UL transmission is less than the length of one slot; L=2 otherwise.

Note: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

The interruptions of NCSG in number of slots are listed in Table 9.1.X3-1 on all serving cells when per-UE NCSG is configured or on FR1 serving cells when per-FR FR1 NCSG is configured to [per-FR measurement gap] capable UE. In case that the UE capable of [per-FR measurement gap] is configured with per-FR FR2 NCSG, numbers of interrupted slots on FR2 serving cells are listed in Table9.1.2X3-2. There are two interruptions in each NCSG occasion, VIL1 before ML and VIL2 after ML, in NR standalone (with single carrier or NR CA). Each of them has number of interrupted slots captured in Table 9.1.2X3-1 and Table9.1.2X3-2.

Table 9.1.9-1: Number of interrupted slots on all serving cells for per-UE NCSG or FR1 serving cells for FR1 NCSG during each VIL in NR standalone operation (with single carrier, NR CA)

|  |  |  |
| --- | --- | --- |
| NR | Number of interrupted slots on serving cells | |
| SCS | When MG timing advance of 0ms is applied | When MG timing advance of 0.5ms is applied |
| (kHz) | VIL=1ms | VIL=1ms |
| 15 | 1 | 2 |
| 30 | 2 | 2 |
| 60 | 4 | 4 |
| 120 | 8 | 8 |
| NOTE 1: NR SCS of 120 kHz is only applicable to the case with per-UE NCSG.  NOTE 2: Non-overlapped half-slots occur before and after the VIL. Whether a UE can receive and/or transmit in those half-slots is up to UE implementation. | | |

**Table 9.1.9-2: Number of interrupted slots on FR2 serving cells for FR2 NCSG during each VIL in NR standalone operation (with single carrier, NR CA)**

|  |  |  |  |
| --- | --- | --- | --- |
| NR | Number of interrupted slots on serving cells | | |
| SCS | When MG timing advance of 0ms is applied | [When MG timing advance of 0.25 ms is applied] | When MG timing advance of 0.75ms is applied |
| (kHz) | VIL=0.75ms | VIL=0.75ms | VIL=0.75ms |
| 60 | 3 | 3 | 3 |
| 120 | 6 | 6 | 6 |
| NOTE 1: Non-overlapped half-slots occur before and after the VIL. Whether a UE can receive and/or transmit in those half-slots is up to UE implementation. | | | |

**< End of change 3>**