**3GPP TSG-RAN WG4 Meeting #112 R4-2411800**

**Maastricht, NL, August 19th – 23th, 2024**

**Agenda item:** 5.15.3

**Source:** Moderator (MediaTek)

**Title:** Topic summary for [112][205] NR\_MG\_enh2

**Document for:** Information

# Introduction

This document is the topic summary for [112][205] NR\_MG\_enh2 with the following topics covered:

* Topic 1: CR handling
* Topic 2: Pre-configured MG and concurrent MG
* Topic 3: NCSG and concurrent MG
* Topic 4: Need For Gap
* Topic 5: Inter-RAT without gaps
* Note: suggested issues for online discussion: TBD.

# Topic #1: Core- and Perf-parts CR handling

## Companies’ contributions summary

### Sub-topic 1-1: Core part CRs handling

**Issue 1-2-1: R4-2411375 [38.133 clause 9.1.2, 9.1.8.1, 9.1.8.2, 9.1.12, 9.1.13] (CATT)**

* Recommended WF
	+ - Status: TBD.

**Issue 1-2-2: R4-2411430 [38.133 clause 9.1.6] (Apple)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-3: R4-2411487 [38.133 clause 9.1.13] (OPPO)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-4: R4-2411615 [38.133 clause 7.8.2.22] (Xiaomi)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-5: R4-2412030 [38.133 clause 8.2.2.2.19] (Nokia)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-6: R4-2412031 [38.133 clause 8.2.2.2, 9.2.1, 9.2.5, 9.3.1, 9.3.9] (Nokia)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-7: R4-2412032 [38.133 clause 7.8.2.22] (Nokia)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-8: R4-2412424 [38.133 clause 9.1.12, 9.1.13] (CMCC)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-9: R4-2412501 [38.133 clause 9.1.12.3, 9.1.12.4] (E///)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-10: R4-2412502 [38.133 clause 9.1.5.3, 9.1.13.2, 9.1.13.3] (E///)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-11: R4-2412635 [38.133 clause 9.1.12.3, 9.1.12.4, 9.1.12.5 (new)] (Huawei)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-12: R4-2412636 [38.133 clause 9.4.8] (Huawei)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-13: R4-2413309 [38.133 clause 8.19.5.1, 8.19.5.2, 8.19.5.3, 9.1.12.3, 9.1.12.4] (Nokia)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-14: R4-2413310 [38.133 clause 9.1.13.1, 9.1.13.2, 9.1.13.3] (Nokia)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-15: R4-2413463 [38.133 clause 9.1.12.2, 9.1.12.3, 9.1.12.4] (MediaTek)**

* Recommended WF
	+ Status: TBD.

### Sub-topic 1-2: Performance part CRs handling

**Issue 1-2-1: R4-2411985 [38.133 clause A.6.6.22.2] (CMCC)**

* Recommended WF
	+ - Status: TBD.

**Issue 1-2-2: R4-2412033 [38.133 clause A.6.6.24.1] (Nokia)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-3: R4-2412637 [38.133 clause A.6.6.22.2, A.7.6.18.1] (Huawei, HiSilicon)**

* Recommended WF
	+ Status: TBD.

**Issue 1-2-4: R4-2412638 [38.133 clause A.7.6.19.1, A.7.6.19.2] (Huawei, HiSilicon)**

* Recommended WF
	+ Status: TBD.

# Topic #2: Concurrent gaps with Pre-MG

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411376**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411376.zip) | CATT | **Proposal 1: CPP measurement should be introduced to the applicability of gap configurations.** **Proposal 2: For UE not supporting dynamic collision for concurrent gap with Pre-MG, the legacy collision and priority rule would apply regardless of the Pre-MG status.**  |
| [**R4-2411429**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411429.zip) | Apple | **Observation 1: minimum requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps are still missing.****Proposal 1: introduce the missing requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps.****Proposal 2: similar to Pre-MG deactivation/activation, 5ms processing delay can be considered for measurement type transition between intra-frequency measurement with NCSG and intra-frequency measurement with Type 1/2 MG upon SCell deactivation.** |
| [**R4-2411987**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411987.zip) | CMCC | **Observation 1: according to RAN2 design, both Rel-16 signalling NeedForGapsInfoNR and Rel-18 signalling NeedForInterruptionNR are applied while NR-DC or NE-DC is not configured, which means that they are applied for SA and EN-DC****Proposal 1: except SA, it is proposed that interruption requirements in 8.2.2.2.19 apply also for EN-DC.****Proposal 2: Rel 18 measurements without gaps with interruptions apply for FR1 HST.****Proposal 3: it is proposed that, from RAN4 point of view, reporting of interRAT-NeedForIntrNR-r18 capability is based on network request, and send LS to RAN2 to request RAN2 to check whether reporting of interRAT-NeedForIntrNR-r18 capability can be done based on network request.****Proposal 4: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE reporting ‘no-gap’ of NeedForGapsInfoNR-r16 shall report NeedForInterruptionNR-r18 to indicate whether innterruption is needed or not.****Proposal 5: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also report interRAT-NeedForInterruptionNR-r18 to differentiate whether innterruption is needed or not.** |
| [**R4-2412029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412029.zip) | Nokia | **Observation 1: Interruptions on PDCCH on the DRX cycle can cause the UE to experience a further delay in UL and DL grants as long as the drx-LongCycle, which can be configured from 10 ms to 10 s.****Observation 2: The impact of interruption is more severe on PDCCH than for PDSCH during DRX activity time.****Proposal 1: Interruptions are not allowed in the DRX ON duration.****Proposal 2: NFG requirements are applicable for NR SA only.****Proposal 3: Send LS to RAN2 informing of the decision.****Observation 3: RAN4 didn’t discuss whether HST should be considered for supporting Rel 18 measurements without gaps with interruptions.****Proposal 4: Rel 18 measurements without gaps with interruptions do not apply for HST.****Proposal 5: RAN4 to agree the proposed changes in R4-2413309 related to UE behavior in case dynamic collisions are not supported.****Proposal 6: RAN4 to agree the proposed changes in R4-2413310 related to UE behavior in case of deactivated SCell measurements with NCSG.** |
| [**R4-2412289**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412289.zip) | vivo | **Proposal 1: For misalignment between DRX-on duration and SMTC for NFG measurements, interruptions are always allowed outside DRX ON duration and it is according to Tcycle, i.e., option 1a.** **Proposal 2: Interruption requirements for Tcycle,i when DRX cycle is configured, option 1 is preferred.****Proposal 3: Prefer NFG requirements are applicable for NR SA only.****Proposal 4: NeedForGaps and NCSG are not expected to be enabled for the same UE at the same time. More clarification is needed for option 2.** **Proposal 5: For the scenario when EMW is configured and fully overlapped with MG, but the periodicity of MG is smaller than EMW, the inter-RAT LTE measurement is performed with EMW, i.e., option 4.****Proposal 6: For UE capability interRAT-NeedForIntrNR-r18, support option 2, i.e., do not change current interRAT-NeedforIntrNR-r18 capability design.****Proposal 7: For “Relations between interRAT-NeedForGaps-r16 and interRAT-NeedForIntrNR-r18 and UE behaviours”, support both option 2 and option 2a.** |
| [**R4-2412500**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412500.zip) | Ericsson | **Observation 1: There is no additional processing delay for UE switching between without gap and with gap/NCSG.****Observation 2: In Rel-15, RAN4 had already solved the power consumption issue for short DRX measurement by introducing scaling factor 1.5.****Observation 3: Rel-16 UE which supports Rel-16 NFG but not supporting Rel-18 NFI can achieve the performance gain due to no gap request from UE.****Observation 4: The performance degradation will be observed for the Rel-18 UEs which only supports Rel-16 NFG capability provided that Rel-18 UE is required to support both Rel-16 NFG and Rel-18 NFI as a pair.****Observation 5: RAN4 already agreed to introduce a new capability in Rel-18 for inter-RAT EUTRAN measurement without gap without interruption decoupled with the Rel-17 inter-RAT EUTRAN measurement capability.****Proposal 1: When UE switches measurement between NCSG and Type 2 MG, no additional processing delay is expected.****Proposal 2: When configured SMTC occasions are misalignment with DRX ON duration, no interruption is allowed during DRX ON duration.****Proposal 3: When configured SMTC occasions are aligned with DRX ON duration, and****• When DRX cycle is equal or smaller than 320ms, Tcycle,i = 1.5\*max(80ms, SMTC, DRX cycle) x CSSF.****• When DRX cycle is larger than 320ms, Tcycle,i = DRX cycle x CSSF****Proposal 4: From NW’s perspective, it’s possible to enable both NCSG and NFG reporting for the same UE at the same time.****Proposal 5: In Rel-18, UE is allowed to optionally report Rel-18 NFI capability for both interRAT-NeedForIntrNR-r18 and NeedForInterruptionNR-r18.****Proposal 6: When a Rel-18 UE only supports Rel-16 NFG capability but does not support Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE.****Proposal 7: When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.****Proposal 8: The scheduling restriction shall be defined when there is with mix-numerology between serving cell and target MO. It shall be applied to the whole EMW if UE doesn’t support mix-numerology between LTE measurement and NR data reception.****Proposal 9: For case b-1 and b-2, UE shall always report EMW patterns regardless of whether no scheduling restriction is expected due to mix-numerology.****Proposal 10: RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.****Proposal 11: When EMW is fully overlapping with MG, UE performs measurement following legacy gap-based requirement.****Proposal 12: RAN4 to agree the following notes for EMW Tinter1.****NOTE 1: When determining UE requirements using Tinter1 for EMW pattern IDs 2, 3, 4, 5, Tinter1 = 60 for gap pattern IDs 2, 4, and Tinter1 = 30 for gap pattern IDs 3 and 5 shall be used.****Proposal 13: In case a-1, Nfreq equals the total number of LTE and NR MOs that are measured outside MG.** |
| [**R4-2413071**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413071.zip) | ZTE Corporation, Sanechips | **Proposal 1: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association].****Observation 1: For an activated SCell, if it is configured to be associated with the Type 1/2 MG but after the deactivation procedure, the status of this SCell is updated to deactivated, then this deactivated SCell would be measured within the NCSG instead of the Type 1/2 MG any more. Such update of applicable gap for this SCell can be performed during the deactivated procedure or during the VIL of NCSG.****Proposal 2: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association]. No the processing delay between NCSG and Type 1/2 MG is needed.** |
| [**R4-2413073**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413073.zip) | ZTE Corporation, Sanechips | **Proposal 1: When Misalignment between DRX-on duration and SMTC, for the case of DRX cycle larger than 320ms, interruptions are not allowed. For the case of DRX cycle not larger than 320ms, interruptions are not allowed in the DRX ON duration, excluding the time extended due to drx-inactivityTimer.****Proposal 2: The interruption is not allowed at least for the small DRX-on duration. For the large DRX-on duration, we can agree that interruption is allowed but except for the last DL slot containing PDCCH in the ON duration.****Proposal 3: Allow to enable both R17 and R18 reporting.****Proposal 4: When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE. When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.** |
| [**R4-2413193**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413193.zip) | Qualcomm Incorporated | **Observation : RAN4 agreed that interruption requirements for DRX is not based on DRX-on duration. Only remaining option is whether interruption are allowed or not in DRX.** **Proposal : Interruption due to measurement without gap is allowed when UE is in DRX regardless of DRX cycle.** **Proposal : The interruption ratio is defined as** * **For DRX, the interruption ratio is defined based on**
	+ **Tcycle,i = max (80ms, DRX cycle) x CSSFoutside\_gap,i, for DRX cycle > 320ms**
	+ **Tcycle,i = max (80ms, SMTC period, DRX cycle) x 1.5 x CSSFoutside\_gap,i, for DRX cycle ≤ 320ms**

**Observation**: Since R16 NFG signalling is for NR-SA only, there is no case that interruption requirement is applied to MR-DC scenario when UE indicate no-gap-with-interruption**Proposal: Support deprioritize MR\_DC for NFG in objective 2 of the WI.****Proposal : RAN4 does not need to further clarify on measurement and interruption requirement in spec. It is already clearly defined in the spec (clause 9.2.1 , 9.3.1)****Observation:** Since UE has separate processing for LTE and NR, even BW is overlapped, we do not think UE can process partially overlapped LTE from NR baseband. For case b-1, separate RF chain and FFT processing is assumed regardless of CRS is partially within active BWP. **Proposal : No scheduling restriction is applied for case b-1, UE indicate nogap-noncsg for inter-RAT EUTRAN measurement without gap.** **Proposal** : **for case b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is smaller than MGRP, RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.****Observation** : If Tinter1 is changed for 60ms and 30ms, UE may not have enough time to finish inter-RAT LTE measurement when EMW occasions are dropped from collision handling**Proposal : Keep the same number in the table. Define note as Tinter1 60ms and 30ms is applied for the requirement when pattern 2,3 are used when EMW dropping rule is not applied****Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **EMW Pattern Id** | **EMW Length (EMWL, ms)** | **EMW Repetition Period****(EMWRP, ms)** | **Minimum available time for inter-RAT measurements during 480 ms period****(Tinter1, ms)** |
| 2 | 2 | 40 | 24 note1 |
| 3 | 2 | 80 | 12 note1 |

* **Note 1 : When determining UE requirements using Tinter1 for EMW IDs 2 and 3, Tinter1 = 60 for EMW ID 2 and Tinter1 = 30 for EMW ID 3 shall be used if EMW dropping rule is not applied specified in clause X. Otherwise, Tinter1 specified in table 2 is applied.**

**Proposal : For UE can perform inter-RAT LTE measurement without gap and does not support EMW, Tinter1 = 60ms is applied for the inter-RAT LTE measurement without gap.** **Observation :** Define interRAT-NeedforIntrNR-r18 under NW control will require big effort for both UE and NW while it is only about signalling indication while nothing changing for UE behavior unless NW configure MG. Gain/benefit is small but it requires big change just for enabling indication. Also it is too late to study. **Proposal : Do not change current interRAT-NeedforIntrNR-r18 capability design. (Do not make reporting of interRAT-NeedForIntrNR-r18 based on NW control)** |

## Open issues summary

### Sub-topic 2-1: Collision handling for dynamic collisions

**Issue 2-1-1: [Case 1] - What is the UE behaviour when the UE doesn’t support dynamic collision FG?**

* Background:
	+ **Agreement from RAN4#111 meeting:**
		- ‘For UE not supporting dynamic collision, the MG will be drop if overlapped with Pre-MG, regardless whether Pre-MG (with higher priority) is activated or deactivated, including the case when the MG overlaps with the Pre-MG activation/deactivation procedure.’
* Proposal:
	+ Option 1: CATT
		- For UE not supporting dynamic collision for concurrent gap with Pre-MG, the legacy collision and priority rule would apply regardless of the Pre-MG status.
* Recommended WF
	+ The moderator understanding that Option 1 is covered in the existing agreement, hence, no need to discuss this issue.

### Sub-topic 2-2: Others

**Issue 2-2-1: [Case 1] – [New issue] Whether to include the CPP measurement in the applicability gap configurations?**

* Proposal:
	+ Option 1: CATT
		- CPP measurement should be introduced to the applicability of gap configurations.
* Recommended WF
	+ Discuss the issue.

# Topic #3: Concurrent gaps with NCSG

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411376**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411376.zip) | CATT | **Proposal 1: CPP measurement should be introduced to the applicability of gap configurations.** **Proposal 2: For UE not supporting dynamic collision for concurrent gap with Pre-MG, the legacy collision and priority rule would apply regardless of the Pre-MG status.**  |
| [**R4-2411429**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411429.zip) | Apple | **Observation 1: minimum requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps are still missing.****Proposal 1: introduce the missing requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps.****Proposal 2: similar to Pre-MG deactivation/activation, 5ms processing delay can be considered for measurement type transition between intra-frequency measurement with NCSG and intra-frequency measurement with Type 1/2 MG upon SCell deactivation.** |
| [**R4-2411987**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411987.zip) | CMCC | **Observation 1: according to RAN2 design, both Rel-16 signalling NeedForGapsInfoNR and Rel-18 signalling NeedForInterruptionNR are applied while NR-DC or NE-DC is not configured, which means that they are applied for SA and EN-DC****Proposal 1: except SA, it is proposed that interruption requirements in 8.2.2.2.19 apply also for EN-DC.****Proposal 2: Rel 18 measurements without gaps with interruptions apply for FR1 HST.****Proposal 3: it is proposed that, from RAN4 point of view, reporting of interRAT-NeedForIntrNR-r18 capability is based on network request, and send LS to RAN2 to request RAN2 to check whether reporting of interRAT-NeedForIntrNR-r18 capability can be done based on network request.****Proposal 4: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE reporting ‘no-gap’ of NeedForGapsInfoNR-r16 shall report NeedForInterruptionNR-r18 to indicate whether innterruption is needed or not.****Proposal 5: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also report interRAT-NeedForInterruptionNR-r18 to differentiate whether innterruption is needed or not.** |
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| [**R4-2412289**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412289.zip) | vivo | **Proposal 1: For misalignment between DRX-on duration and SMTC for NFG measurements, interruptions are always allowed outside DRX ON duration and it is according to Tcycle, i.e., option 1a.** **Proposal 2: Interruption requirements for Tcycle,i when DRX cycle is configured, option 1 is preferred.****Proposal 3: Prefer NFG requirements are applicable for NR SA only.****Proposal 4: NeedForGaps and NCSG are not expected to be enabled for the same UE at the same time. More clarification is needed for option 2.** **Proposal 5: For the scenario when EMW is configured and fully overlapped with MG, but the periodicity of MG is smaller than EMW, the inter-RAT LTE measurement is performed with EMW, i.e., option 4.****Proposal 6: For UE capability interRAT-NeedForIntrNR-r18, support option 2, i.e., do not change current interRAT-NeedforIntrNR-r18 capability design.****Proposal 7: For “Relations between interRAT-NeedForGaps-r16 and interRAT-NeedForIntrNR-r18 and UE behaviours”, support both option 2 and option 2a.** |
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| [**R4-2413071**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413071.zip) | ZTE Corporation, Sanechips | **Proposal 1: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association].****Observation 1: For an activated SCell, if it is configured to be associated with the Type 1/2 MG but after the deactivation procedure, the status of this SCell is updated to deactivated, then this deactivated SCell would be measured within the NCSG instead of the Type 1/2 MG any more. Such update of applicable gap for this SCell can be performed during the deactivated procedure or during the VIL of NCSG.****Proposal 2: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association]. No the processing delay between NCSG and Type 1/2 MG is needed.** |
| [**R4-2413073**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413073.zip) | ZTE Corporation, Sanechips | **Proposal 1: When Misalignment between DRX-on duration and SMTC, for the case of DRX cycle larger than 320ms, interruptions are not allowed. For the case of DRX cycle not larger than 320ms, interruptions are not allowed in the DRX ON duration, excluding the time extended due to drx-inactivityTimer.****Proposal 2: The interruption is not allowed at least for the small DRX-on duration. For the large DRX-on duration, we can agree that interruption is allowed but except for the last DL slot containing PDCCH in the ON duration.****Proposal 3: Allow to enable both R17 and R18 reporting.****Proposal 4: When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE. When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.** |
| [**R4-2413193**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413193.zip) | Qualcomm Incorporated | **Observation : RAN4 agreed that interruption requirements for DRX is not based on DRX-on duration. Only remaining option is whether interruption are allowed or not in DRX.** **Proposal : Interruption due to measurement without gap is allowed when UE is in DRX regardless of DRX cycle.** **Proposal : The interruption ratio is defined as** * **For DRX, the interruption ratio is defined based on**
	+ **Tcycle,i = max (80ms, DRX cycle) x CSSFoutside\_gap,i, for DRX cycle > 320ms**
	+ **Tcycle,i = max (80ms, SMTC period, DRX cycle) x 1.5 x CSSFoutside\_gap,i, for DRX cycle ≤ 320ms**

**Observation**: Since R16 NFG signalling is for NR-SA only, there is no case that interruption requirement is applied to MR-DC scenario when UE indicate no-gap-with-interruption**Proposal: Support deprioritize MR\_DC for NFG in objective 2 of the WI.****Proposal : RAN4 does not need to further clarify on measurement and interruption requirement in spec. It is already clearly defined in the spec (clause 9.2.1 , 9.3.1)****Observation:** Since UE has separate processing for LTE and NR, even BW is overlapped, we do not think UE can process partially overlapped LTE from NR baseband. For case b-1, separate RF chain and FFT processing is assumed regardless of CRS is partially within active BWP. **Proposal : No scheduling restriction is applied for case b-1, UE indicate nogap-noncsg for inter-RAT EUTRAN measurement without gap.** **Proposal** : **for case b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is smaller than MGRP, RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.****Observation** : If Tinter1 is changed for 60ms and 30ms, UE may not have enough time to finish inter-RAT LTE measurement when EMW occasions are dropped from collision handling**Proposal : Keep the same number in the table. Define note as Tinter1 60ms and 30ms is applied for the requirement when pattern 2,3 are used when EMW dropping rule is not applied****Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **EMW Pattern Id** | **EMW Length (EMWL, ms)** | **EMW Repetition Period****(EMWRP, ms)** | **Minimum available time for inter-RAT measurements during 480 ms period****(Tinter1, ms)** |
| 2 | 2 | 40 | 24 note1 |
| 3 | 2 | 80 | 12 note1 |

* **Note 1 : When determining UE requirements using Tinter1 for EMW IDs 2 and 3, Tinter1 = 60 for EMW ID 2 and Tinter1 = 30 for EMW ID 3 shall be used if EMW dropping rule is not applied specified in clause X. Otherwise, Tinter1 specified in table 2 is applied.**

**Proposal : For UE can perform inter-RAT LTE measurement without gap and does not support EMW, Tinter1 = 60ms is applied for the inter-RAT LTE measurement without gap.** **Observation :** Define interRAT-NeedforIntrNR-r18 under NW control will require big effort for both UE and NW while it is only about signalling indication while nothing changing for UE behavior unless NW configure MG. Gain/benefit is small but it requires big change just for enabling indication. Also it is too late to study. **Proposal : Do not change current interRAT-NeedforIntrNR-r18 capability design. (Do not make reporting of interRAT-NeedForIntrNR-r18 based on NW control)** |

## Open issues summary

### Sub-topic 3-1: Rel-18 UE behavior for deactivated SCell measurements with NCSG

* Agreement from previous meetings:

|  |
| --- |
| **< Agreement >**: * **New in Rel-18**
	+ When Type-2 MG and NCSG are both configured, some serving cell MOs may associated to the NCSG and some are not.
		- Question 1: What is the expected UE behaviour (assume SMTC partially overlapped with NCSG)
			* Option 1: skip gap association, all deactivated Scells are measured within NCSG. (This implies some new rule to override the existing gap association rule)
			* Option 2: Still follow the gap association, i.e., (This implies we follow Rel-17 gap association rule)
				+ Deactivated Scell MO associated with NCSG is measured within NCSG
				+ Deactivated Scell MO not associated with NCSG is measured outside NCSG
		- Question 2: Whether additional UE capability indication is needed
 |

**Issue 3-1-1: When the UE is configured with Concurrent gaps with NCSG, what is the potential changes to UE behaviour for NCSG upon SCell activation (in Rel-18)**

Background: Agreement from online session:

* For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association].
	+ Further details on the processing delay between NCSG and Type 1/2 MG can be further discussed.
* For UE configured with 2 NCSG, deactivated SCells are measured with NCSG
	+ If the association is provided, deactivated SCells are measured with NCSG according to gap association.
	+ If the association is not provided, UE is not expected to cause interruption outside the VIL due to measurement on any of the deactivated SCells, and the existing measurement delay requirement does not apply to this case.
* Proposals
	+ Option 1: Apple [starting from R17?]
		- Introduce missing processing requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps.
			* similar to Pre-MG deactivation/activation, 5ms processing delay can be considered for measurement type transition between intra-frequency measurement with NCSG and intra-frequency measurement with Type 1/2 MG upon SCell deactivation.
	+ Option 2: E///, ZTE
		- When UE switches measurement between NCSG and Type 2 MG, no additional processing delay is expected.
* Recommended WF
	+ Discuss the options.

# Topic #4: NeedForGap

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411376**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411376.zip) | CATT | **Proposal 1: CPP measurement should be introduced to the applicability of gap configurations.** **Proposal 2: For UE not supporting dynamic collision for concurrent gap with Pre-MG, the legacy collision and priority rule would apply regardless of the Pre-MG status.**  |
| [**R4-2411429**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411429.zip) | Apple | **Observation 1: minimum requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps are still missing.****Proposal 1: introduce the missing requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps.****Proposal 2: similar to Pre-MG deactivation/activation, 5ms processing delay can be considered for measurement type transition between intra-frequency measurement with NCSG and intra-frequency measurement with Type 1/2 MG upon SCell deactivation.** |
| [**R4-2411987**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411987.zip) | CMCC | **Observation 1: according to RAN2 design, both Rel-16 signalling NeedForGapsInfoNR and Rel-18 signalling NeedForInterruptionNR are applied while NR-DC or NE-DC is not configured, which means that they are applied for SA and EN-DC****Proposal 1: except SA, it is proposed that interruption requirements in 8.2.2.2.19 apply also for EN-DC.****Proposal 2: Rel 18 measurements without gaps with interruptions apply for FR1 HST.****Proposal 3: it is proposed that, from RAN4 point of view, reporting of interRAT-NeedForIntrNR-r18 capability is based on network request, and send LS to RAN2 to request RAN2 to check whether reporting of interRAT-NeedForIntrNR-r18 capability can be done based on network request.****Proposal 4: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE reporting ‘no-gap’ of NeedForGapsInfoNR-r16 shall report NeedForInterruptionNR-r18 to indicate whether innterruption is needed or not.****Proposal 5: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also report interRAT-NeedForInterruptionNR-r18 to differentiate whether innterruption is needed or not.** |
| [**R4-2412029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412029.zip) | Nokia | **Observation 1: Interruptions on PDCCH on the DRX cycle can cause the UE to experience a further delay in UL and DL grants as long as the drx-LongCycle, which can be configured from 10 ms to 10 s.****Observation 2: The impact of interruption is more severe on PDCCH than for PDSCH during DRX activity time.****Proposal 1: Interruptions are not allowed in the DRX ON duration.****Proposal 2: NFG requirements are applicable for NR SA only.****Proposal 3: Send LS to RAN2 informing of the decision.****Observation 3: RAN4 didn’t discuss whether HST should be considered for supporting Rel 18 measurements without gaps with interruptions.****Proposal 4: Rel 18 measurements without gaps with interruptions do not apply for HST.****Proposal 5: RAN4 to agree the proposed changes in R4-2413309 related to UE behavior in case dynamic collisions are not supported.****Proposal 6: RAN4 to agree the proposed changes in R4-2413310 related to UE behavior in case of deactivated SCell measurements with NCSG.** |
| [**R4-2412289**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412289.zip) | vivo | **Proposal 1: For misalignment between DRX-on duration and SMTC for NFG measurements, interruptions are always allowed outside DRX ON duration and it is according to Tcycle, i.e., option 1a.** **Proposal 2: Interruption requirements for Tcycle,i when DRX cycle is configured, option 1 is preferred.****Proposal 3: Prefer NFG requirements are applicable for NR SA only.****Proposal 4: NeedForGaps and NCSG are not expected to be enabled for the same UE at the same time. More clarification is needed for option 2.** **Proposal 5: For the scenario when EMW is configured and fully overlapped with MG, but the periodicity of MG is smaller than EMW, the inter-RAT LTE measurement is performed with EMW, i.e., option 4.****Proposal 6: For UE capability interRAT-NeedForIntrNR-r18, support option 2, i.e., do not change current interRAT-NeedforIntrNR-r18 capability design.****Proposal 7: For “Relations between interRAT-NeedForGaps-r16 and interRAT-NeedForIntrNR-r18 and UE behaviours”, support both option 2 and option 2a.** |
| [**R4-2412500**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412500.zip) | Ericsson | **Observation 1: There is no additional processing delay for UE switching between without gap and with gap/NCSG.****Observation 2: In Rel-15, RAN4 had already solved the power consumption issue for short DRX measurement by introducing scaling factor 1.5.****Observation 3: Rel-16 UE which supports Rel-16 NFG but not supporting Rel-18 NFI can achieve the performance gain due to no gap request from UE.****Observation 4: The performance degradation will be observed for the Rel-18 UEs which only supports Rel-16 NFG capability provided that Rel-18 UE is required to support both Rel-16 NFG and Rel-18 NFI as a pair.****Observation 5: RAN4 already agreed to introduce a new capability in Rel-18 for inter-RAT EUTRAN measurement without gap without interruption decoupled with the Rel-17 inter-RAT EUTRAN measurement capability.****Proposal 1: When UE switches measurement between NCSG and Type 2 MG, no additional processing delay is expected.****Proposal 2: When configured SMTC occasions are misalignment with DRX ON duration, no interruption is allowed during DRX ON duration.****Proposal 3: When configured SMTC occasions are aligned with DRX ON duration, and****• When DRX cycle is equal or smaller than 320ms, Tcycle,i = 1.5\*max(80ms, SMTC, DRX cycle) x CSSF.****• When DRX cycle is larger than 320ms, Tcycle,i = DRX cycle x CSSF****Proposal 4: From NW’s perspective, it’s possible to enable both NCSG and NFG reporting for the same UE at the same time.****Proposal 5: In Rel-18, UE is allowed to optionally report Rel-18 NFI capability for both interRAT-NeedForIntrNR-r18 and NeedForInterruptionNR-r18.****Proposal 6: When a Rel-18 UE only supports Rel-16 NFG capability but does not support Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE.****Proposal 7: When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.****Proposal 8: The scheduling restriction shall be defined when there is with mix-numerology between serving cell and target MO. It shall be applied to the whole EMW if UE doesn’t support mix-numerology between LTE measurement and NR data reception.****Proposal 9: For case b-1 and b-2, UE shall always report EMW patterns regardless of whether no scheduling restriction is expected due to mix-numerology.****Proposal 10: RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.****Proposal 11: When EMW is fully overlapping with MG, UE performs measurement following legacy gap-based requirement.****Proposal 12: RAN4 to agree the following notes for EMW Tinter1.****NOTE 1: When determining UE requirements using Tinter1 for EMW pattern IDs 2, 3, 4, 5, Tinter1 = 60 for gap pattern IDs 2, 4, and Tinter1 = 30 for gap pattern IDs 3 and 5 shall be used.****Proposal 13: In case a-1, Nfreq equals the total number of LTE and NR MOs that are measured outside MG.** |
| [**R4-2413071**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413071.zip) | ZTE Corporation, Sanechips | **Proposal 1: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association].****Observation 1: For an activated SCell, if it is configured to be associated with the Type 1/2 MG but after the deactivation procedure, the status of this SCell is updated to deactivated, then this deactivated SCell would be measured within the NCSG instead of the Type 1/2 MG any more. Such update of applicable gap for this SCell can be performed during the deactivated procedure or during the VIL of NCSG.****Proposal 2: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association]. No the processing delay between NCSG and Type 1/2 MG is needed.** |
| [**R4-2413073**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413073.zip) | ZTE Corporation, Sanechips | **Proposal 1: When Misalignment between DRX-on duration and SMTC, for the case of DRX cycle larger than 320ms, interruptions are not allowed. For the case of DRX cycle not larger than 320ms, interruptions are not allowed in the DRX ON duration, excluding the time extended due to drx-inactivityTimer.****Proposal 2: The interruption is not allowed at least for the small DRX-on duration. For the large DRX-on duration, we can agree that interruption is allowed but except for the last DL slot containing PDCCH in the ON duration.****Proposal 3: Allow to enable both R17 and R18 reporting.****Proposal 4: When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE. When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.** |
| [**R4-2413193**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413193.zip) | Qualcomm Incorporated | **Observation : RAN4 agreed that interruption requirements for DRX is not based on DRX-on duration. Only remaining option is whether interruption are allowed or not in DRX.** **Proposal : Interruption due to measurement without gap is allowed when UE is in DRX regardless of DRX cycle.** **Proposal : The interruption ratio is defined as** * **For DRX, the interruption ratio is defined based on**
	+ **Tcycle,i = max (80ms, DRX cycle) x CSSFoutside\_gap,i, for DRX cycle > 320ms**
	+ **Tcycle,i = max (80ms, SMTC period, DRX cycle) x 1.5 x CSSFoutside\_gap,i, for DRX cycle ≤ 320ms**

**Observation**: Since R16 NFG signalling is for NR-SA only, there is no case that interruption requirement is applied to MR-DC scenario when UE indicate no-gap-with-interruption**Proposal: Support deprioritize MR\_DC for NFG in objective 2 of the WI.****Proposal : RAN4 does not need to further clarify on measurement and interruption requirement in spec. It is already clearly defined in the spec (clause 9.2.1 , 9.3.1)****Observation:** Since UE has separate processing for LTE and NR, even BW is overlapped, we do not think UE can process partially overlapped LTE from NR baseband. For case b-1, separate RF chain and FFT processing is assumed regardless of CRS is partially within active BWP. **Proposal : No scheduling restriction is applied for case b-1, UE indicate nogap-noncsg for inter-RAT EUTRAN measurement without gap.** **Proposal** : **for case b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is smaller than MGRP, RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.****Observation** : If Tinter1 is changed for 60ms and 30ms, UE may not have enough time to finish inter-RAT LTE measurement when EMW occasions are dropped from collision handling**Proposal : Keep the same number in the table. Define note as Tinter1 60ms and 30ms is applied for the requirement when pattern 2,3 are used when EMW dropping rule is not applied****Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **EMW Pattern Id** | **EMW Length (EMWL, ms)** | **EMW Repetition Period****(EMWRP, ms)** | **Minimum available time for inter-RAT measurements during 480 ms period****(Tinter1, ms)** |
| 2 | 2 | 40 | 24 note1 |
| 3 | 2 | 80 | 12 note1 |

* **Note 1 : When determining UE requirements using Tinter1 for EMW IDs 2 and 3, Tinter1 = 60 for EMW ID 2 and Tinter1 = 30 for EMW ID 3 shall be used if EMW dropping rule is not applied specified in clause X. Otherwise, Tinter1 specified in table 2 is applied.**

**Proposal : For UE can perform inter-RAT LTE measurement without gap and does not support EMW, Tinter1 = 60ms is applied for the inter-RAT LTE measurement without gap.** **Observation :** Define interRAT-NeedforIntrNR-r18 under NW control will require big effort for both UE and NW while it is only about signalling indication while nothing changing for UE behavior unless NW configure MG. Gain/benefit is small but it requires big change just for enabling indication. Also it is too late to study. **Proposal : Do not change current interRAT-NeedforIntrNR-r18 capability design. (Do not make reporting of interRAT-NeedForIntrNR-r18 based on NW control)** |

## Open issues summary

### Sub-topic 4-1 DRX

**Issue 4-1-1: Misalignment between DRX-on duration and SMTC for NFG measurements**

* Background (agreement):
	+ - Interruption ratio requirement not based on DRX-on duration
		- Not define the interruption location
* Proposals
	+ Option 1:
		- Option 1a: vivo
			* + Interruptions are always allowed outside DRX ON duration and it is according to Tcycle,i.
		- Option 1b: Nokia, E///
			* + Interruptions are not allowed during DRX ON duration.
		- Option 1c: ZTE
			* + For the case of DRX cycle larger than 320ms, interruptions are not allowed when DRX cycle is larger than 320ms.
		- Option 1d: ZTE
			* + For the case of DRX cycle not larger than 320ms, interruptions are not allowed in the DRX ON duration, excluding the time extended due to drx-inactivityTimer.
	+ Option 2: QC
		- * Interruption due to measurement without gap is allowed when UE is in DRX regardless of DRX cycle.
	+ Recommended WF
		- Discuss the options.

**Issue 4-1-2: Aligned DRX-on duration and SMTC for NFG measurements**

* Agreement
	+ Interruption ratio requirement not based on DRX-on duration
	+ Not define the interruption location
	+ Proposals
		- Option 1: ZTE
			* The interruption is not allowed at least for the small DRX-on duration. For the large DRX-on duration, we can agree that interruption is allowed but except for the last DL slot containing PDCCH in the ON duration
		- Option 2: QC
			* Interruption due to measurement without gap is allowed when UE is in DRX regardless of DRX cycle.
	+ Recommended WF
		- Discuss the options.

**Issue 4-1-3: Interruption requirements for Tcycle,i when DRX cycle is configured and aligned with SMTC occasions**

* Proposals
	+ Option 1: vivo, E///, QC
		- * For DRX, the interruption ratio is defined based on
		- Tcycle,i = max (80ms, DRX cycle) x CSSFoutside\_gap,i, for DRX cycle > 320ms
		- Tcycle,i = max (80ms, SMTC period, DRX cycle) x 1.5 x CSSFoutside\_gap,i, for DRX cycle ≤ 320ms
	+ Recommended WF
		- Option 1 is agreeable.

### Sub-topic 4-2 MRDC interruption requirements

**Issue 4-2-1: Interruption requirements in 8.2.2.2.19 apply also for NR-DC, EN-DC, and NE-DC**

* Background:
	+ the NFG signalling is used in NR SA only, as shown below:

|  |
| --- |
| **From 38.331**:– *NeedForGapsInfoNR*The IE *NeedForGapsInfoNR* indicates whether measurement gap is required for the UE to perform SSB based measurements on an NR target band while NR-DC or NE-DC is not configured. |

* Proposals
	+ Option 1: CMCC
		- * Yes.
				+ Interruption requirements in 8.2.2.2.19 shall also apply for NR-DC, EN-DC, and NE-DC considering that operations in one cell group do not impact operations on another cell group.
	+ Option 2: Nokia, vivo, QC, MTK
		- * No,
				+ NFG requirements are applicable for NR SA only.
* Recommended WF
	+ Provided that the R16 signalling doesn’t support the NR-DC or EN-DC, then support Option 2.

### Sub-topic 4-3 Others in NFG

**Issue 4-3-1: further clarification on the measurement and interruption spec about gap/BWP configurations**

* Proposals
	+ Option 1: QC
		- * Do not clarify. RAN4 does not need to further clarify on measurement and interruption requirement in spec. It is already clearly defined in the spec (clause 9.2.1 , 9.3.1)

**Issue 4-3-2: NFG and NCSG capabilities**

* Previous Agreements
	+ No need to establish the mapping between UE’s indication for NeedForGaps and NCSG.
* Proposals
	+ Option 1: vivo, MTK
		- * NeedForGaps and NCSG are not expected to be enabled for the same UE at the same time.
	+ Option 2: E///, ZTE
		- * From NW’s perspective, it’s possible to enable both NCSG and NFG reporting for the same UE at the same time.

**Issue 4-3-3: Cross feature support**

* Background (agreement)
	+ - Rel-18 requirements for UE supporting NFG and inter-RAT measurements without gap do not apply for FR2-2.
* Proposals
	+ Proposal 1: Whether to have Rel 18 measurements without gaps with interruptions do not apply for HST.
		- * Option 1: Yes [CMCC]
			* Option 2: No [Nokia]
* Recommended WF:
	+ - Discuss the options.

### Sub-topic 4-4 UE capabilities

**Issue 4-4-1: Relations between nr-NeedForGap-Reporting-r16 and nr-NeedForInterruptionReport-r18 and UE behaviours**

* Previous agreements

|  |
| --- |
| **Issue 1-1-2: Scenario 2, NR measurements without gaps****Tentative agreements**1. “no-gap” as part of NeedForGapsInfoNR-r16=FALSE means that the UE support measurement without gaps
	1. The UE may or may not cause interruption.
2. if UE causes interruptions when performing measurements without gaps:
	1. Support early implementation of Rel-18 NeedForInterruption:
		1. Optional since R17
	2. FFS the UE behavior if the Rel-18 UE does not support NeedForInterruptionNR-r18
 |

* Proposals
	+ Option 1: CMCC
		- A Rel-18 UE indicating support of nr-NeedForGap-Reporting-r16 shall also indicate support of nr-NeedForInterruptionReport-r18.
	+ Option 2: E///, ZTE
		- When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE.
		- Option 2a: E///, ZTE
			* When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.
	+ Option 3: E///
		- In Rel-18, UE is allowed to optionally report Rel-18 NFI capability for both interRAT-NeedForIntrNR-r18 and NeedForInterruptionNR-r18.
	+ Recommended WF
		- Discuss the options.

# Topic #5: Inter-RAT without gaps

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411376**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411376.zip) | CATT | **Proposal 1: CPP measurement should be introduced to the applicability of gap configurations.** **Proposal 2: For UE not supporting dynamic collision for concurrent gap with Pre-MG, the legacy collision and priority rule would apply regardless of the Pre-MG status.**  |
| [**R4-2411429**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411429.zip) | Apple | **Observation 1: minimum requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps are still missing.****Proposal 1: introduce the missing requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps.****Proposal 2: similar to Pre-MG deactivation/activation, 5ms processing delay can be considered for measurement type transition between intra-frequency measurement with NCSG and intra-frequency measurement with Type 1/2 MG upon SCell deactivation.** |
| [**R4-2411987**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411987.zip) | CMCC | **Observation 1: according to RAN2 design, both Rel-16 signalling NeedForGapsInfoNR and Rel-18 signalling NeedForInterruptionNR are applied while NR-DC or NE-DC is not configured, which means that they are applied for SA and EN-DC****Proposal 1: except SA, it is proposed that interruption requirements in 8.2.2.2.19 apply also for EN-DC.****Proposal 2: Rel 18 measurements without gaps with interruptions apply for FR1 HST.****Proposal 3: it is proposed that, from RAN4 point of view, reporting of interRAT-NeedForIntrNR-r18 capability is based on network request, and send LS to RAN2 to request RAN2 to check whether reporting of interRAT-NeedForIntrNR-r18 capability can be done based on network request.****Proposal 4: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE reporting ‘no-gap’ of NeedForGapsInfoNR-r16 shall report NeedForInterruptionNR-r18 to indicate whether innterruption is needed or not.****Proposal 5: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also report interRAT-NeedForInterruptionNR-r18 to differentiate whether innterruption is needed or not.** |
| [**R4-2412029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412029.zip) | Nokia | **Observation 1: Interruptions on PDCCH on the DRX cycle can cause the UE to experience a further delay in UL and DL grants as long as the drx-LongCycle, which can be configured from 10 ms to 10 s.****Observation 2: The impact of interruption is more severe on PDCCH than for PDSCH during DRX activity time.****Proposal 1: Interruptions are not allowed in the DRX ON duration.****Proposal 2: NFG requirements are applicable for NR SA only.****Proposal 3: Send LS to RAN2 informing of the decision.****Observation 3: RAN4 didn’t discuss whether HST should be considered for supporting Rel 18 measurements without gaps with interruptions.****Proposal 4: Rel 18 measurements without gaps with interruptions do not apply for HST.****Proposal 5: RAN4 to agree the proposed changes in R4-2413309 related to UE behavior in case dynamic collisions are not supported.****Proposal 6: RAN4 to agree the proposed changes in R4-2413310 related to UE behavior in case of deactivated SCell measurements with NCSG.** |
| [**R4-2412289**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412289.zip) | vivo | **Proposal 1: For misalignment between DRX-on duration and SMTC for NFG measurements, interruptions are always allowed outside DRX ON duration and it is according to Tcycle, i.e., option 1a.** **Proposal 2: Interruption requirements for Tcycle,i when DRX cycle is configured, option 1 is preferred.****Proposal 3: Prefer NFG requirements are applicable for NR SA only.****Proposal 4: NeedForGaps and NCSG are not expected to be enabled for the same UE at the same time. More clarification is needed for option 2.** **Proposal 5: For the scenario when EMW is configured and fully overlapped with MG, but the periodicity of MG is smaller than EMW, the inter-RAT LTE measurement is performed with EMW, i.e., option 4.****Proposal 6: For UE capability interRAT-NeedForIntrNR-r18, support option 2, i.e., do not change current interRAT-NeedforIntrNR-r18 capability design.****Proposal 7: For “Relations between interRAT-NeedForGaps-r16 and interRAT-NeedForIntrNR-r18 and UE behaviours”, support both option 2 and option 2a.** |
| [**R4-2412500**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412500.zip) | Ericsson | **Observation 1: There is no additional processing delay for UE switching between without gap and with gap/NCSG.****Observation 2: In Rel-15, RAN4 had already solved the power consumption issue for short DRX measurement by introducing scaling factor 1.5.****Observation 3: Rel-16 UE which supports Rel-16 NFG but not supporting Rel-18 NFI can achieve the performance gain due to no gap request from UE.****Observation 4: The performance degradation will be observed for the Rel-18 UEs which only supports Rel-16 NFG capability provided that Rel-18 UE is required to support both Rel-16 NFG and Rel-18 NFI as a pair.****Observation 5: RAN4 already agreed to introduce a new capability in Rel-18 for inter-RAT EUTRAN measurement without gap without interruption decoupled with the Rel-17 inter-RAT EUTRAN measurement capability.****Proposal 1: When UE switches measurement between NCSG and Type 2 MG, no additional processing delay is expected.****Proposal 2: When configured SMTC occasions are misalignment with DRX ON duration, no interruption is allowed during DRX ON duration.****Proposal 3: When configured SMTC occasions are aligned with DRX ON duration, and****• When DRX cycle is equal or smaller than 320ms, Tcycle,i = 1.5\*max(80ms, SMTC, DRX cycle) x CSSF.****• When DRX cycle is larger than 320ms, Tcycle,i = DRX cycle x CSSF****Proposal 4: From NW’s perspective, it’s possible to enable both NCSG and NFG reporting for the same UE at the same time.****Proposal 5: In Rel-18, UE is allowed to optionally report Rel-18 NFI capability for both interRAT-NeedForIntrNR-r18 and NeedForInterruptionNR-r18.****Proposal 6: When a Rel-18 UE only supports Rel-16 NFG capability but does not support Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE.****Proposal 7: When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.****Proposal 8: The scheduling restriction shall be defined when there is with mix-numerology between serving cell and target MO. It shall be applied to the whole EMW if UE doesn’t support mix-numerology between LTE measurement and NR data reception.****Proposal 9: For case b-1 and b-2, UE shall always report EMW patterns regardless of whether no scheduling restriction is expected due to mix-numerology.****Proposal 10: RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.****Proposal 11: When EMW is fully overlapping with MG, UE performs measurement following legacy gap-based requirement.****Proposal 12: RAN4 to agree the following notes for EMW Tinter1.****NOTE 1: When determining UE requirements using Tinter1 for EMW pattern IDs 2, 3, 4, 5, Tinter1 = 60 for gap pattern IDs 2, 4, and Tinter1 = 30 for gap pattern IDs 3 and 5 shall be used.****Proposal 13: In case a-1, Nfreq equals the total number of LTE and NR MOs that are measured outside MG.** |
| [**R4-2413071**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413071.zip) | ZTE Corporation, Sanechips | **Proposal 1: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association].****Observation 1: For an activated SCell, if it is configured to be associated with the Type 1/2 MG but after the deactivation procedure, the status of this SCell is updated to deactivated, then this deactivated SCell would be measured within the NCSG instead of the Type 1/2 MG any more. Such update of applicable gap for this SCell can be performed during the deactivated procedure or during the VIL of NCSG.****Proposal 2: For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association]. No the processing delay between NCSG and Type 1/2 MG is needed.** |
| [**R4-2413073**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413073.zip) | ZTE Corporation, Sanechips | **Proposal 1: When Misalignment between DRX-on duration and SMTC, for the case of DRX cycle larger than 320ms, interruptions are not allowed. For the case of DRX cycle not larger than 320ms, interruptions are not allowed in the DRX ON duration, excluding the time extended due to drx-inactivityTimer.****Proposal 2: The interruption is not allowed at least for the small DRX-on duration. For the large DRX-on duration, we can agree that interruption is allowed but except for the last DL slot containing PDCCH in the ON duration.****Proposal 3: Allow to enable both R17 and R18 reporting.****Proposal 4: When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE. When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.** |
| [**R4-2413193**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413193.zip) | Qualcomm Incorporated | **Observation : RAN4 agreed that interruption requirements for DRX is not based on DRX-on duration. Only remaining option is whether interruption are allowed or not in DRX.** **Proposal : Interruption due to measurement without gap is allowed when UE is in DRX regardless of DRX cycle.** **Proposal : The interruption ratio is defined as** * **For DRX, the interruption ratio is defined based on**
	+ **Tcycle,i = max (80ms, DRX cycle) x CSSFoutside\_gap,i, for DRX cycle > 320ms**
	+ **Tcycle,i = max (80ms, SMTC period, DRX cycle) x 1.5 x CSSFoutside\_gap,i, for DRX cycle ≤ 320ms**

**Observation**: Since R16 NFG signalling is for NR-SA only, there is no case that interruption requirement is applied to MR-DC scenario when UE indicate no-gap-with-interruption**Proposal: Support deprioritize MR\_DC for NFG in objective 2 of the WI.****Proposal : RAN4 does not need to further clarify on measurement and interruption requirement in spec. It is already clearly defined in the spec (clause 9.2.1 , 9.3.1)****Observation:** Since UE has separate processing for LTE and NR, even BW is overlapped, we do not think UE can process partially overlapped LTE from NR baseband. For case b-1, separate RF chain and FFT processing is assumed regardless of CRS is partially within active BWP. **Proposal : No scheduling restriction is applied for case b-1, UE indicate nogap-noncsg for inter-RAT EUTRAN measurement without gap.** **Proposal** : **for case b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is smaller than MGRP, RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.****Observation** : If Tinter1 is changed for 60ms and 30ms, UE may not have enough time to finish inter-RAT LTE measurement when EMW occasions are dropped from collision handling**Proposal : Keep the same number in the table. Define note as Tinter1 60ms and 30ms is applied for the requirement when pattern 2,3 are used when EMW dropping rule is not applied****Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **EMW Pattern Id** | **EMW Length (EMWL, ms)** | **EMW Repetition Period****(EMWRP, ms)** | **Minimum available time for inter-RAT measurements during 480 ms period****(Tinter1, ms)** |
| 2 | 2 | 40 | 24 note1 |
| 3 | 2 | 80 | 12 note1 |

* **Note 1 : When determining UE requirements using Tinter1 for EMW IDs 2 and 3, Tinter1 = 60 for EMW ID 2 and Tinter1 = 30 for EMW ID 3 shall be used if EMW dropping rule is not applied specified in clause X. Otherwise, Tinter1 specified in table 2 is applied.**

**Proposal : For UE can perform inter-RAT LTE measurement without gap and does not support EMW, Tinter1 = 60ms is applied for the inter-RAT LTE measurement without gap.** **Observation :** Define interRAT-NeedforIntrNR-r18 under NW control will require big effort for both UE and NW while it is only about signalling indication while nothing changing for UE behavior unless NW configure MG. Gain/benefit is small but it requires big change just for enabling indication. Also it is too late to study. **Proposal : Do not change current interRAT-NeedforIntrNR-r18 capability design. (Do not make reporting of interRAT-NeedForIntrNR-r18 based on NW control)** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 5-1 Scheduling restriction

**Issue 5-1-1: Scheduling restriction due to mixed numerology for case b-2**

* Proposals
	+ - Option 1: E///
		- The scheduling restriction shall be defined for inter-RAT LTE measurement case b-2 with mixed numerology, -- serving cell and target MO have mixed SCS and they are in the same band, and UE does not support mixed SCS between serving cell (NR data reception) and target MO (LTE measurement).
* Recommended WF
	+ Discuss the options.

**Issue 5-1-2: Scheduling restriction for case b-1**

* Proposals
	+ Option 1 : QC
		- No scheduling restriction is applied for UE indicate nogap-noncsg for inter-RAT EUTRAN measurement without gap.
* Recommended WF
	+ Discuss the options.

**Issue 5-1-3: Scheduling restrictions and UE capability reporting**

* Proposals
	+ Option 1:
		- For case b-1 and b-2, UE shall always report EMW patterns regardless of whether no scheduling restriction is expected due to mix-numerology.
* Recommended WF
	+ Discuss the options.

### Sub-topic 5-2 Measurement reporting period requirements

**Issue 5-2-1: Overlap between Effective measurement window and SMTC/SSB**

* ***Background***
	+ Previous Agreements
		- For case b-2, when EMW is configured overlapped with SMTC/SSB/CSI-RS measurement with scheduling restrictions, inter-RAT LTE measurement will be dropped.
		- For case b-1 and b-2, when EMW is partially overlapped with MG (EMW periodicity < MGRP), the EMW occasion colliding physically with MG will be dropped.



* Proposals to: For case b-1 and b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is smaller than MGRP,
	+ Option 1: E///, QC
		- RAN4 to update the legacy agreements as: after considering EMW dropping rule if EMW is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT meas will be performed within MG.
* Recommended WF
	+ Discuss the options.

**Issue 5-2-2: Overlap between Effective measurement window and MG**

* ***Background***
	+ Agreements
		- For case b-1 and b-2, when EMW is partially overlapped with MG (EMW periodicity < MGRP), the EMW occasion colliding physically with MG will be dropped.
		- Note: The proximity rule in Rel-17 does not apply in this case.
* Agreement for down-selection: For case b-1 and b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is larger than MGRP and all EMW are covered by measurement gaps,
	+ ~~Option 1: inter-RAT LTE measurement will be dropped.~~
	+ ~~Option 2: No UE behaviour is specified.~~
* Proposals to: For case b-1 and b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is larger than MGRP and all EMW are covered by measurement gaps,
	+ Option 3: E///, MTK
		- apply legacy gap-based measurement requirements, i.e. RAN4 requirements should NOT be defined based on EMW.
	+ Option 4: vivo
		- UE measurement requirements are based on EMW-RP.
* Recommended WF
	+ Discuss the options.

**Issue 5-2-3: Tinter1 for EMW configuration:**

Table 2

|  |  |  |  |
| --- | --- | --- | --- |
| **EMW Pattern Id** | **EMW Length (EMWL, ms)** | **EMW Repetition Period****(EMWRP, ms)** | **Minimum available time for inter-RAT measurements during 480 ms period****(Tinter1, ms)** |
| 2 | 2 | 40 | [24] |
| 3 | 2 | 80 | [12] |

* Proposals
	+ Option 1: E///
		- When determining UE requirements using Tinter1 for EMW pattern IDs 2, 3, 4, 5, Tinter1 = 60 for gap pattern IDs 2, 4, and Tinter1 = 30 for gap pattern IDs 3 and 5 shall be used.
	+ Option 2: QC
		- When determining UE requirements using Tinter1 for EMW IDs 2 and 3, Tinter1 = 60 for EMW ID 2 and Tinter1 = 30 for EMW ID 3 shall be used if EMW dropping rule is not applied specified in clause X. Otherwise, Tinter1 specified in table 2 is applied.
* Recommended WF
	+ Discuss the options.

**Issue 5-2-4: Tinter1 without EMW configuration**

* Proposals
	+ Option 1: QC
	+ For UE can perform inter-RAT LTE measurement without gap and does not require a scheduling restrictions, Tinter1 = 60ms is applied for the inter-RAT LTE measurement without gap.
* Recommended WF
	+ Discuss the options.

**Issue 5-2-5: Scaling factor for case a-1: Nfreq definition**

* ***Background***
	+ The principles are different between NR MO outside gap and LTE inter-frequency without MG, where all inter-frequency MOs, regardless if they are measured with or without MG, are counted in the same Nfreq.
* Proposals
	+ Option 1: E///
		- total number of LTE and NR MOs that are measured outside MG (same principle as LTE SA).
			* Option 1a: MTK
				+ total number of inter-frequency LTE and NR MOs (same principle as LTE SA).
* Recommended WF
	+ Discuss the options.

### Sub-topic 5-3 UE capabilities

**Issue 5-3-1: case a-1: The issue with UE capability interRAT-NeedForIntrNR-r18**

* Background (agreements)
	+ ~~Option 1: Interruptions due to interRAT NR measurements without gaps must be explicitly allowed by the network (via SIB or other means). Send LS to RAN2.~~
* Proposals
	+ - Option 2: QC, vivo
		- Do not change current interRAT-NeedforIntrNR-r18 capability design. Not to make reporting of interRAT-NeedForIntrNR-r18 based on NW control. Do not further discuss how to report UE capability interRAT-NeedForIntrNR-r18.
		- Option 3: CMCC
		- interRAT-NeedForIntrNR-r18 capability is based on network request. Send LS to RAN2.
* Recommended WF
	+ Discuss the options.

**Issue 5-3-2: Relations between interRAT-NeedForGaps-r16 and interRAT-NeedForIntrNR-r18 and UE behaviours**

* Previous agreements

|  |
| --- |
| **Issue 1-1-1: Scenario 1, LTE – NR inter-RAT measurement** **Tentative agreements**1. interRAT-NeedForGaps-r16=FALSE means that the UE support measurement without gaps
	1. The UE may or may not cause interruption.
2. if UE causes interruptions when performing measurements without gaps:
	1. Support early implementation of Rel-18 NeedForInterruption:
		1. Optional since R17
	2. FFS mandatory report of the UE capability R18 interRAT-NeedForIntrNR-r18 from Rel-18 UE if the UE reports interRAT-NeedForGaps-r16=FALSE
	3. FFS the UE behavior if the Rel-18 UE does not support interRAT-NeedForIntrNR-r18
 |

* Proposals
	+ Option 1: CMCC
	+ A Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also indicate support of interRAT-NeedForInterruptionNR-r18.
	+ Option 2: E///, vivo
	+ When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE.
		- Option 2a: E///, vivo
		- When a Rel-18 UE supports both Rel-16 NFG and Rel-18 NFI capabilities, but NW doesn’t configure Rel-18 needForInterruptionConfigNR, the UE’s behaviour is the same as Rel-16 UE.
* Recommended WF
	+ Discuss the options.

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