**3GPP TSG-RAN WG4 Meeting # 111 R4-2408005**

**Fukuoka, Japan, 20th – 24th May 2024**

**Agenda item:** 7.5.5

**Source:** Moderator (Intel Corporation)

**Title:** Topic summary for [111][208] NR\_MG\_enh2\_part2

**Document for:** Information

# Introduction and recommendations

This document is the TDocs summary for [111][208] NR\_MG\_enh2\_part2 with the following topics covered.

* Topic 1 and Topic 2: Maintenance part for Measurement without gaps for UEs reporting *NeedForGapInfoNR* and inter-RAT measurement without gap (AI 7.5.2)
* Topic 3: Performance part requirements and test cases (AI 7.5.4)

The performance part of this item is expected to be complete after this WG meeting. The moderator is thankful for all the efforts made from companies and all the contributions are appreciated.

The moderator recommends the below topics to be discussed during the online session under the Vice Chair guidance.

The recommendation to discuss the below issues online is in order of priority identified by the moderator.

***Test cases***

**Test cases list and configurations for inter-RAT**

***UE features***

**Issue 2-3-2: Additional UE capability for scheduling restriction of case a-1**

**Issue 2-3-3: Remove FG32-4 from prerequisite feature groups for FG 32-7.**

**Issue 2-3-4: Update FG 32-5 description.**

**Issue 2-3-5: Update FG 32-4 description.**

***NFG***

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

**Issue 1-1-2: Aligned DRX-on duration and SMTC for NFG measurements and: DRX ON duration is SHORT and DRX cycle is LARGE**

**Issue 1-1-3: Aligned DRX-on duration and SMTC for NFG measurements and: DRX ON duration is LONG and DRX cycle is SMALL**

**Issue 1-1-4: DRX ON duration SHORT and LONG threshold**

**Issue 1-1-5: DRX cycle SMALL and LARGE threshold**

**Issue 1-1-6a: Interruption requirements for Tcycle,i when DRX cycle is configured**

***Inter-RAT***

**Issue 2-2-2: Tinter1 for EMW configuratios:**

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

**Issue 2-2-3: Scaling factor for case a-1: Nfreq definition**

# Topic #1 and #2: Core part maintenance

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2407346 | Apple | Discussion on core maintenance for measurements without gaps**Proposal 1: Interruption is allowed once every DRX cycle, and it is according to Tcycle,i.****Proposal 2: when DRX is configured and DRX cycle is larger than 320ms, interruption is still allowed, and it is according to Tcycle,i.****Proposal 3: when DRX is configured and DRX cycle is equal or shorter than 320ms, interruption is still allowed, and it is according to Tcycle,i.****Proposal 4: The scheduling restriction will be applied to the whole EMW if UE doesn’t support mix-numerology between LTE measurement and NR data reception.****Proposal 5: it is ok to assume “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”. However, it is preferred to avoid such configuration from network.** |
| R4-2407876 | OPPO | Discussion on core requirements for measurements without gap**Proposal 1: No interruption is allowed in case of large DRX cycle with small ON duration, and interruption is allowed in the other scenarios.****Proposal 2: Large DRX cycle means DRX cycle > 320ms, small DRX ON duration means ON duration < 5ms.****Proposal 3: NFG requirements are applicable for NR SA only.****Proposal 4: Clarify in the spec that [no gap with interruption] requirements only apply when gap is not configured, or SMTC is fully non-overlapped with gap.****Proposal 5: Define scheduling restriction applicable to the whole EMW if UE does not support capability [32-7].** **Proposal 6: Support option 1: 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 7: Whether interRAT-NeedForIntrNR-r18 capability is controlled by network request should be discussed in RAN2. Send LS to RAN2.** |
| R4-2408166 | CMCC | (NR\_MG\_enh2-Core) Discussion on open issues for measurements without gaps ***Proposal 1: for DRX cycle larger than 320ms, no interruption is expected.******Proposal 2: for DRX cycle no larger than 320ms, if SMTC occasions are misaligned with DRX ON duration, no interruption is expected.******Proposal 3: it is proposed that interruption requirements in 8.2.2.2.19 apply also for NR-DC, EN-DC, and NE-DC.******Proposal 4: 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 5: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE reporting ‘no-gap’ of NeedForGapsInfoNR-r16 shall to report NeedForInterruptionNR-r18.******Proposal 6: to avoid ambiguity issue existed in previous release, it is proposed that a Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also indicate support of interRAT-NeedForInterruptionNR-r18.*** |
| R4-2408244 | ZTE | Discussion on measurement without gaps for UEs reporting NeedForGapsInfoNR**Proposal 1: To move forward, Option 1a, 2a, 5 and 6 are preferred.**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Small DRX cycle** | **Large DRX cycle** |
| **Option 1a** | **Small DRX ON** | **No interruption during DRX ON** | **No interruption during DRX ON** |
| **Large DRX ON** | **No interruption during DRX ON** | **No interruption during DRX ON** |
| **Option 2a** | **Small DRX ON** | **Interruption allowed once per Tcycle** | **No interruption during DRX ON** |
| **Large DRX ON** | **Interruption allowed once per Tcycle** | **No interruption during DRX ON** |
| **Option 5** | **Small DRX ON** | **No interruption on last PDCCH slot of DRX ON** | **No interruption during DRX ON** |
| **Large DRX ON** | **No interruption on last PDCCH slot of DRX ON** | **No interruption on last PDCCH slot of DRX ON** |
| **Option 6** | **Small DRX ON** | **Interruption allowed once per Tcycle** | **No interruption during DRX ON** |
| **Large DRX ON** | **Interruption allowed once per Tcycle** | **Interruption allowed once per Tcycle** |

**Proposal 2: Allow to enable both R17 and R18 reporting.** |
| R4-2408322 | Ericsson | Remaining issues on measurement without gaps***Observation 1: 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 2: 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 3: 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.******Observation 4: In Rel-15, RAN4 had already solved the power consumption issue for short DRX measurement by introducing scaling factor 1.5.******Proposal 1: In Rel-18, UE is allowed to optional report Rel-18 NFI capability for both interRAT-NeedForIntrNR-r18 and NeedForInterruptionNR-r18.******Proposal 2: 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.******Proposal 3: 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 4: When configured SMTC occasions are misalignment with DRX ON duration, no interruption is expected during DRX ON duration.******Proposal 5: When DRX cycle is larger than 320ms, no interruption is expected.******Proposal 6: When configured SMTC occasions are aligned with DRX ON duration and DRX cycle is equal or smaller than 320ms, interruption is allowed and it is according to Tcycle,i = 1.5\*max(80ms, SMTC, DRX cycle) x CSSF.******Proposal 7: 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 8: 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 9: 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 10: When EMW is fully overlapping with MG, UE performs measurement following legacy gap-based requirement.******Proposal 11: 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 12: In case a-1, Nfreq equals the total number of LTE and NR MOs that are measured outside MG.*** |
| R4-2408431 | Qualcomm | Remaining issues on R18 NFG**Observation**: Interruption location is unspecified for R18 needforinterruption because R16 NFG implementation can be different for different UE. **Observation**: Coupling DRX on duration and interruption requirement imply the interruption location is known. This is not logically true. There was no restriction from DRX configuration even for interruptions during measurements on deactivated SCC where interruption location and length is specified. **Proposal: DRX configurations other than DRX cycle such as on duration or drx-inactiviytimer are not relevant for R18 interruption requirement for R16 NFG. UE measurements can affect DRX-on duration. Interruption is allowed once every DRX cycle, and it is according to Tcycle,i.*** **Tcycle,­i = max (80ms, SMTCi, DRXcycle) , DRXcycle <=320ms**
* **Tcycle,i = DRXcycle, DRXcycle >320ms.**

**Observation:** It is not logically valid that for NCSG capable UE does not required scheduling restriction when CRS is outside of BWP but scheduling restriction may be required when CRS is partially or fully overlapped case which implies vacant chain is only applied for certain scenario and UE dynamically change the FFT functionality whether share or independent depends on CRS location which does not make sense. **Proposal: Remove CRS location restriction for FG32-4 and update FG32-4 description “Support inter-RAT EUTRAN measurements without gap for UE indicates nogap-noncsg”****Proposal: No scheduling restriction is applied for UE indicate nogap-noncsg for inter-RAT EUTRAN measurement without gap.** **Observation:** Scheduling restriction is not required under vacant chain assumption and FG32-4 required vacant chain. But UE can use EMW configuration for measurement requirements.**Proposal: Remove FG32-4 from prerequisite feature groups for FG 32-7.****Proposal** : **for case b-1, EMW dropping rule is not applied when EMW is collided with SMTC/SSB/CSI-RS as LTE measurement is performed with vacant chain and scheduling restriction is not required.****Proposal : Update FG32-5 description “Support of inter-RAT EUTRAN measurements without gap when CRS is completely contained within UE’s active DL BWP”****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.****Proposal** : **for case b-1, EMW dropping rule is not applied when EMW is collided with SMTC/SSB/CSI-RS as LTE measurement is performed with vacant chain and scheduling restriction is not required.****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****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** : Nfreq is used for both measurement with gap and without gap in 36.133. case a-1 is already covered by current definition in 36.133. **Proposal : RAN4 does not need to revise or introduce new scaling factor for case a-1. Nfreq in 36.133 is reused for case a-1.****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)** |
| R4-2408485 | Intel Corporation | Feature list proposals for measurement gap enhancements |
| R4-2408621 | Vivo | Remaining maintenance issues for measurements without gaps **Proposal 1: For misalignment between DRX-on duration and SMTC for NFG measurements, interruption is allowed once every DRX cycle, and it is according to Tcycle,i. Option 2 can be used as a compromise, either 320ms or other value can be considered.** **Proposal 2: For the aligned DRX-on duration and SMTC scenario, prefer interruption is always allowed, and it is according to Tcycle,i for both DRX>320ms and DRX<= 320ms scenario.****Proposal 3: Prefer NFG requirements are applicable for NR SA only.****Proposal 4: For the scheduling restriction, support both option 1 and 1a.** **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 “Relations between interRAT-NeedForGaps-r16 and interRAT-NeedForIntrNR-r18 and UE behaviours”, support both option 2 and option 2a.** |
| R4-2409144 | Nokia | Discussion on measurements without gaps1. An interruption during the On-duration or while the DRX-InactivityTimer is running may cause the UE to miss out on PDCCH scheduling of uplink and/or downlink resources.
2. Missing a PDCCH will waste the scheduled resources from a NW perspective and cause a delay in data transfer of up to the Drx-LongCycle.
3. drx-onDurationTimer can be as small as 1/32 ms
4. Interruption lengths of 0.25 to 1 ms during short DRX ON duration would have extremely large impact on UE throughput, since it could cover the whole DRX ON duration.
5. 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.
6. The impact of interruption is more severe on PDCCH than for PDSCH during DRX activity time.
7. If DRX cycles are very small, there may not be sufficient time between DRX ON durations to allow for interruptions and therefore, interruptions should be allowed during DRX ON durations if DRX cycle are very small.
8. RAN4 to consider rules of when interruptions are allowed in when DRX is configured depending on the DRX ON duration, and DRX cycle configuration.
9. Interruptions may be allowed during DRX ON duration under the following conditions:
	1. if DRX ON duration is smaller than or equal to 10 ms and the DRX cycle is larger than 40 ms:
		1. Interruptions are not allowed in the DRX ON duration.
	2. Otherwise:
		1. Interruptions are allowed in the DRX ON duration, except for the last slot containing PDCCH in the DRX ON duration.
10. In the latest spec version, interruption requirements are only defined for SA carrier aggregation scenario.
11. 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.
12. Agreement from RAN4#106 that intra-frequency measurements without gaps don’t cause interruption when target SSB is completely contained withing the active BWP of the UE is not captured in the latest specification.
13. Capture in the specification the agreement from RAN4#106 that intra-frequency measurements without gaps don’t cause interruption when target SSB is completely contained withing the active BWP of the UE.
14. RAN4 didn’t discuss whether HST and FR2-2 should be considered for supporting Rel 18 measurements without gaps with interruptions.
15. Rel 18 measurements without gaps with interruptions do not apply for HST.
16. Rel 18 measurements without gaps with interruptions do not apply for operation above 52.6 GHz.
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| R4-2409151 | Nokia, China Unicom, Deutsche Telekom, Orange, NTT DOCOMO, INC., TELECOM ITALIA S.p.A., Telia Company, T-Mobile USA, Vodafone | Discussion on Rel-18 capabilitiesObservation 1: Early implementation of nr-NeedForInterruptionReport-r18 and interRAT-NeedForInterruptionNR-r18 has been proposed as solution for ambiguity in Rel-16 requirements.Proposal 1: A Rel-18 UE indicating support of nr-NeedForGap-Reporting-r16 shall also indicate if interruptions are needed.Proposal 2: A Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also indicate if interruptions are needed. Proposal 3: No new RRM test cases are defined for a Rel-18 UE supporting signalling in proposal 1 and 2. |
| R4-2409250 | Huawei | Discussion on remaining issues for measurement without MG**Proposal 1: Adopt the following interruption requirements for DRX.*** **During DRX ON duration**
	+ **if DRX ON duration is <= [5]ms and DRX cycle is > [80]ms, interruptions are not allowed**
	+ **otherwise, interruptions are allowed except for the last DL slot**
* **Outside DRX ON duration**
	+ **interruptions are allowed**

**Proposal 2: 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**

**Proposal 3: NFG requirements are applicable for NR SA only.****Proposal 4: Do not make additional clarification on the applicability of [no gap with interruption] requirements.****Proposal 5: NeedForGaps and NCSG are not expected to be enabled for the same UE at the same time.****Proposal 6: Do not make additional clarification on whether interruption is allowed when target SSB is completely contained within the active BWP.****Proposal 7: Do not further discuss scheduling restriction due to mixed numerology for Case b-1/2.****Proposal 8: RAN4 to update the requirements for Case b-1 and b-2:****after considering EMW dropping rule if EMW outside MG is colliding with SMTC/SSB/CSI-RS, when the remaining EMW is fully overlapping with MG, the inter-RAT measurement will be performed within MG.****Proposal 9: For Case b-1 and b-2 inter-RAT LTE measurement causing scheduling restriction, if EMW is fully overlapping with MG and EMW periodicity larger than MGRP, UE measurement requirements are based on EMW-RP.****Proposal 10: Define Tinter1 for EMW pattern 2 and 3 as 60ms and 30ms.****Proposal 11: Define Tinter1 without EMW configuration as 60ms (based on EMW pattern 0).****Proposal 12: For Case a-1, RAN4 to discuss the calculation of Nfreq** * **Option 1: number of NR MOs that are measured outside MG (same principle as NR SA)**
* **Option 2: total number of LTE and NR MOs (same principle as LTE SA)**

**Proposal 13: It is optional for R18 UE to support R18 NFG when it indicates ‘no-gap’ via R16 NFG signaling. R18 NFG requirements do not apply for R18 UE that does not support R18 NFG.****Proposal 14: Introduce an E-UTRA FG x-z for scheduling restriction (TP in the Annex).****Proposal 15: Correct typos in FG 32-6 (TP in the Annex).** |
| R4-2409745 | MediaTek Inc. | Discussion on measurement without gaps **Proposal 1:** **For DRX based interruption ratio when DRX is configured equal or larger than 160ms, interruption is not allowed in the DRX ON duration, excluding the case of DRX-on period is extended due to drx-inactivityTimer.****Proposal 2:** **For aligned DRX-on duration with SMTC, interruption is always allowed and it is according to Tcycle,i.****Proposal 3: Interruption is not allowed in the DRX-on duration, which is equal or smaller than 10ms and DRX cycle is equal or larger than 160ms.****Proposal 4: When the UE is allowed cause interruption in DRX-on then no restriction on which PDCCH occasions shall be interrupted by the UE.****Proposal 5: Apply 1.5 to measurement and interruption requirements when DRX is configured and equal or smaller than 320ms.****Proposal 6: Deprioritize MR-DC for NFG in Objective 2 of this WI.****Proposal 7: 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 and target MO. The scheduling restriction will be applied to the whole EMW if UE doesn’t support mix-numerology between LTE measurement and NR data reception.****Proposal 8: For Cases b-1 and b-2: When the UE require NO scheduling restriction for a specific carrier: the UE reports to the NW that the UE can measure the a given/specific carrier frequency of inter-RAT EUTRAN without gap and without interruption; the UE shall not report EMW.****Proposal 9: For Cases b-1 and b-2: When the UE require scheduling restriction for a specific carrier: when the UE support EMW capability, then the UE shall report the support of effective measurement window (EMW) for inter-RAT EUTRAN capability.****Proposal 10: For Cases b-1 and b** **When the UE require scheduling restriction for a specific carrier: when the UE doesn’t support EMW capability, the UE shall report NCSG, or gaps.****Proposal 11: For case b-1 and b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is smaller than MGRP, 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 measurements will be left to UE implementation (i.e. no requirements defined for this case).****Proposal 12: When the EMW is fully overlapped with the MG, yet the MG periodicity is smaller than that of EMW, the UE should perform all the measurements within the MG, i.e. RAN4 requirements should not follow EMW configuration.****Proposal 13: The scaling factor for case a-1 shall be total number of inter-frequency LTE and NR MOs (same principle as LTE SA).****Proposal 14: RAN4 shall define an additional UE capability for scheduling restriction of Case a-1.** |
| R4-2407692Moved from 4.4 | MediaTek inc. | (NR\_RRM\_enh-Core) Remaining issues for Rel-16 NeedforGap**Proposal 1: Keep interRAT-NeedForIntrNR-r18 optional for Rel-18 UEs if the UE reports interRAT-NeedForGaps-r16=FALSE****Proposal 2: For UEs not supporting interRAT-NeedForIntrNR-r18 or NeedForInterruptionNR-r18, whether UE needs interruption or not is undefined** |
| R4-2408245Moved from 4.4 | ZTE Corporation, Sanechips | [NR\_RRM\_enh-Core] Discussion on interruption requirements for Rel-16 NeedForGaps**Observation 1: For the UE capability of interRAT-NeedForGaps-r16, if UE reporting FALSE, then no gap no interruption; For the UE capability of interFreqNeedForGaps-r16, if UE reporting FALSE, then no gap no interruption; For the UE capability of interRAT-NeedForGapsNR-r16, if UE reporting FALSE, it is not clear whether interruption allowed, ambiguity exists, UE may or may not cause interruption.****Observation 2: Early implementation of interRAT-NeedForInterruptionNR-r18 can avoid the ambiguity, but such R18 UE capability is optional.** **Proposal 1: For the R16/17/18 UE, only reporting interRAT-NeedForGapsNR-r16 or reporting interRAT-NeedForGapsNR-r16=FALSE plus interRAT-NeedForInterruptionNR-r18 are both allowed.** **Observation 3: For intra-NR, both R16 NFG and R18 NeedForInterruption share similar mechanism, i.e. including semi-static UE capability, NW request and dynamic UE reporting. Whether request the dynamic UE reporting, totally depend on NW decision.****Observation 4: Both R16 NFG and R18 NeedForInterruption capabilities are optional for the R16/17/18 UE.****Proposal 2: For the capable UE, whether request the R16 NFG dynamic reporting and/or R18 NeedForInterruption dynamic reporting, depend on NW decision.** |
| R4-2407347 | Apple | Draft CR of core maintenance for measurements without gaps (8.2.2.2.19) |
| R4-2407831 | Xiaomi | Draft CR on NFG core part maintenance (9.2.1, 9.2.5.2, 9.2.5.2) |
| R4-2407839 | Xiaomi | draftCR on interruprion requirements for inter-RAT NR measurement without gap (case a-1) (36.133 7.8.2.22) |
| R4-2408169 | CMCC | (NR\_MG\_enh2-Core) DraftCR on measurement delay for NFG (9.3.1, 9.3.9.1, 9.3.9.2, 9.3.9.4) |
| R4-2408432 | Qualcomm Incorporated | Draft CR for R18 inter-RAT measurement without gap (9.4.1, 9.4.8.1, 9.4.8.3.5, 9.4.8.4.5) |
| R4-2408486 | Intel Corporation | Maintenance CR on interruption requirements for measurements without gap (8.2.2.2.19) |
| R4-2409145 | Nokia | Draft CR 38.133 measurements without gaps (8.2.2.2.19, 9.2.1, 9.2.5, 9.3.1, 9.3.9.2) |
| R4-2409146 | Nokia | Draft CR 36.133 measurements without gaps (36.133 7.8.2.22) |
| R4-2409251 | Huawei | draftCR on requirements for inter-RAT LTE measurement without gap (9.4.8.2, 9.4.8.3.5, 9.4.8.4.5) |

## Open issues summary for topic #1

### Sub-topic 1-1 DRX

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

* Proposals
	+ Option 1:
		- Option 1a: Interruptions are always allowed outside DRX ON duration and it is according to Tcycle,i.
		- Option 1b: Interruptions are not allowed during DRX ON duration.
		- Option 1c: Interruptions are not allowed when DRX cycle is larger than 320ms.
	+ Option 2: Interruptions are allowed under the conditions of issues 1-1-2, 1-1-3, 1-1-4.
* Recommended WF
	+ Discussion needed.

**Issue 1-1-2: Aligned DRX-on duration and SMTC for NFG measurements and: DRX ON duration is SHORT and DRX cycle is LARGE**

* Proposals
	+ Option 1: Interruption is always allowed, and it is according to Tcycle,i.
		- Option 1a: interruption is always allowed but except for the last DL slot containing PDCCH in the ON duration.
	+ Option 2: UE does not measure within SMTC occasions and no interruption is allowed.
	+ Option 3: Interruptions are not allowed in the DRX ON duration.
* Recommended WF
	+ Discuss on the options.

**Issue 1-1-3: Aligned DRX-on duration and SMTC for NFG measurements and: DRX ON duration is LONG and DRX cycle is SMALL**

* Proposals
	+ Option 1: Interruption is always allowed, and it is according to Tcycle,i.
	+ Option 2: interruption is always allowed but except for the last DL slot containing PDCCH in the ON duration.
* Recommended WF
	+ Agree on Option 1 and discuss option 1a.

**Issue 1-1-4: DRX ON duration SHORT and LONG threshold**

* Proposals
	+ Option 1: 5ms.
	+ Option 2: 10ms.
* Recommended WF
	+ Need discussions.

**Issue 1-1-5: DRX cycle SMALL and LARGE threshold**

* Proposals
	+ Option 1: 80ms.
	+ Option 2: 160ms.
	+ Option 3: 320ms.
* Recommended WF
	+ Need discussions.

**Issue 1-1-6a: Interruption requirements for Tcycle,i when DRX cycle is configured**

* Proposals
	+ Option 1: 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
	+ Option 2:
		- Tcycle,i = DRXcycle, DRXcycle >320ms.
		- Tcycle,i = max (80ms, SMTCi, DRXcycle) , DRXcycle <=320ms
* Recommended WF
	+ Need discussions.

### Sub-topic 1-2 MRDC interruption requirements

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

* Proposals
	+ Option 1: 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 1a: Same interruption requirement defined at 7.8.2.22 in 36.133 and 8.2.2.2.19 in 38.133 are applied for each cell group for UE perform NR measurement without gap with interruption.
			* 7.8.2.22 in 36.133 and 8.2.2.2.19 in 38.133 is applied for MCG and SCG, respectively in EN-DC,
			* 7.8.2.22 in 36.133 and 8.2.2.2.19 in 38.133 is applied for SCG and MCG, respectively in NE-DC,
			* 8.2.2.2.19 in 38.133 is applied for both MCG and SCG in NR-DC.
	+ Option 2: NFG requirements are applicable for NR SA only.
		- Option 2a: deprioritize MR\_DC for NFG in objective 2 of the WI.
* Recommended WF
	+ Agree on option 1.

### Sub-topic 1-3 Others in NFG

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

* Proposals
	+ Option 1a: Clarify in the spec that [no gap with interruption] requirements only apply when gap is not configured, or gap is fully non-overlapped with SMTC on any carriers which are measured with interruption.
	+ Option 1b: Capture in the specification the agreement from RAN4#106 that intra-frequency measurements without gaps don’t cause interruption when target SSB is completely contained withing the active BWP of the UE.
	+ Option 2: Do not clarify.
* Recommended WF
	+ Discussion is needed.

**Issue 1-3-2: NFG and NCSG capabilities**

* Previous Agreements
	+ No need to establish the mapping between UE’s indication for NeedForGaps and NCSG.
* Proposals
	+ Option 1: NeedForGaps and NCSG are not expected to be enabled for the same UE at the same time.
* Recommended WF
	+ Agree on option 1.

**Issue 1-3-3: Cross feature support**

* Proposals
	+ Proposal 1: Rel 18 measurements without gaps with interruptions do not apply for HST.
	+ Proposal 2: Rel 18 measurements without gaps with interruptions do not apply for operation above 52.6 GHz.
* Recommended WF
	+ Discussion needed

### Sub-topic 1-4 UE capabilities

**Issue 1-4-1: 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: A Rel-18 UE indicating support of nr-NeedForGap-Reporting-r16 shall also indicate support of nr-NeedForInterruptionReport-r18.
	+ Option 2: 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: 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: A Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also indicate if interruptions are needed.
		- No new RRM test cases are defined for a Rel-18 UE supporting signalling above.
* Recommended WF

## Open issues summary for topic #2

Up to this meeting, all agreed using scenarios for inter-RAT NR/LTE measurements without gap can summarized as:

1. the inter-RAT NR measurements without gap in Rel18 includes the two scenarios below.
	* **Case a-1**: UE performing the measurements without gap in NR carriers as there is vacant RF chains for UE measurements
2. the inter-RAT LTE measurements without gap in Rel18 includes the two scenarios below.
	* **Case b-1**: UE performing the measurements without gap in LTE carriers as there is vacant RF chains for UE measurements
	* **Case b-2**: LTE CRS are fully contained within UE’s active BWP

### Sub-topic 2-1 Scheduling restriction

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

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

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

**Issue 2-2-1: 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: 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 upon the option.

**Issue 2-2-1a: 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.
* 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 1: inter-RAT LTE measurement will be dropped.~~
	+ ~~Option 2: No UE behaviour is specified.~~
	+ Option 3: apply legacy gap-based measurement requirements, i.e. RAN4 requirements should NOT be defined based on EMW.
	+ Option 4: UE measurement requirements are based on EMW-RP.
* Recommended WF
	+ Discuss upon the option 3 and 4.

**Issue 2-2-2: Tinter1 for EMW configuratios:**

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: Update the Tinter1 for EMW pattern 2/3 to 60/30ms.

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | [60] |
| 3 | 2 | 80 | [30] |

* + Option 2: 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 3: 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
	+ Agree the note based on option 2.

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

* Proposals
	+ Option 1: Define Tinter1 without EMW configuration as 60ms (based on EMW pattern 0).
	+ Option 2: 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 upon option 1 and 2.

**Issue 2-2-3: 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: number of NR MOs that are measured outside MG (same principle as NR SA).
	+ Option 2: total number of LTE and NR MOs (same principle as LTE SA).
* Recommended WF
	+ Discuss upon options.

### Sub-topic 2-3 UE capabilities

**Issue 2-3-1: case a-1: The issue with UE capability interRAT-NeedForIntrNR-r18**

* Proposals
	+ ~~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.~~
	+ Option 2: 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: interRAT-NeedForIntrNR-r18 capability is based on network request. Send LS to RAN2.
* Recommended WF
	+ Agree on option 2.

**Issue 2-3-1a: 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: A Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also indicate support of interRAT-NeedForInterruptionNR-r18.
	+ Option 2: 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: 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: A Rel-18 UE indicating support of interRAT-NeedForGapsNR-r16 shall also indicate if interruptions are needed.
		- No new RRM test cases are defined for a Rel-18 UE supporting signalling above.
* Recommended WF

|  |
| --- |
|  |

**Issue 2-3-2: Additional UE capability for scheduling restriction of case a-1**

* Proposals
	+ Option 1: Introduce an E-UTRA FG x-z for scheduling restriction due to mixed numerology.
* Recommended WF
	+ Agree to option 1.

**Issue 2-3-3: Remove FG32-4 from prerequisite feature groups for FG 32-7.**

* Proposals
	+ Option 1: Remove.
* Recommended WF
	+ Discussion is needed.

**Issue 2-3-4: Update FG 32-5 description.**

* Proposals
	+ Option 1: Support of inter-RAT EUTRAN measurements without gap when CRS is completely contained within UE’s active DL BWP.
* Recommended WF
	+ Discussion is needed.

**Issue 2-3-5: Update FG 32-4 description.**

* Proposals
	+ Option 1: Remove CRS location restriction for FG32-4 and update FG32-4 description “Support inter-RAT EUTRAN measurements without gap for UE indicates nogap-noncsg”.
* Recommended WF
	+ Discussion is needed.

**Issue 2-3-8: Feature list tables for inter-RAT measurements without gap baseline before the meeting for information**

Table 1: Rel-18 NR UE features for NR\_MG\_enh2 WI.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 32. NR\_MG\_enh2 | 32-4 | Inter-RAT EUTRAN measurements without gap and outside active DL BWP | Support inter-RAT EUTRAN measurements outside active DL BWP for nogap-noncsg  | 19-1b | Yes | NA | UE does not meet the requirements of inter-RAT EUTRAN measurements without gap in TS 38.133 and the UE behavior is unknown to network | Per UE | No | No | N.A |  | Optional with capability signalling |
| 32. NR\_MG\_enh2 | 32-5 | Inter-RAT EUTRAN measurement without gap and within active DL BWP | Support of inter-RAT EUTRAN measurements without gap when CRS is contained within UE’s active DL BWP |  | Yes | No | Measurement gap will be needed for inter-RAT EUTRAN measurements | Per UE | No | FR1 only | N.A |  | Optional with capability signalling |
| 32. NR\_MG\_enh2 | 32-6 | Effective measurement window for inter-RAT EUTRAN measurements | Support configuration of effective measurement window for inter-RAT EUTRAN measurements, including offset, duration and periodicity.  | 32-4 or 32-5 | Yes | No | UE is not allowed to cause scheduling restriction defined in TS 38.133 for 32-6 or 32-7 | Per UE | No | No | N.A | * A bitmap for 6 effective measurement window (EMW) patterns defined in TS 38.133.
* #0 and #1 are mandatory, if UE supports EMW feature.

Other patterns are optionalNote: If UE supports 32-6 or 32-7 and UE requires scheduling restriction, UE should support this FG | Optional with capability signalling |
| 32. NR\_MG\_enh2 | 32-7 | Simultaneous reception of NR data and EUTRAN CRS with different numerology | Support concurrent inter-RAT measurement on EUTRAN cell in non-DSS with CRS and PDCCH or PDSCH reception from the serving cell with a different numerology |  32-4 or 32-5 | Yes | No | scheduling restriction is applicable | Per UE | No | FR1 only | N.A |  | Optional with capability signalling |

Table 2: Rel-18 LTE UE features for NR\_MG\_enh2 WI.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 32. NR\_MG\_enh2 | x-y | interRAT-NeedForInterruptionNR-r18 | Support of inter-RAT NR measurements without gap with or without interruption when the interRAT-NeedForGapsNR-r16 is false.Note: This feature already has a defined UE capability: ‘interRAT-NeedForInterruptionNR-r18’. The intention of adding this FG is only keep consistency between 38.822 and 36.306. | interRAT-NeedForGapsNR-r16 | Yes | NA | The UE does not support inter-RAT NR measurements without gap with or without interruption for performing inter-RAT NR measurement without gap | [Per target band per BC]Note: the same granularity as interRAT-NeedForGapsNR-r16 | No | No | NA | Candidate value: “{no-gap-with-interruption, no-gap-no-interruption}” | Optional with capability signalling |

## CR list

|  |  |  |
| --- | --- | --- |
| R4-2407347 | Apple | Draft CR of core maintenance for measurements without gaps (8.2.2.2.19) |
| R4-2407831 | Xiaomi | Draft CR on NFG core part maintenance (9.2.1, 9.2.5.2, 9.2.5.2) |
| R4-2407839 | Xiaomi | draftCR on interruprion requirements for inter-RAT NR measurement without gap (case a-1) (36.133 7.8.2.22) |
| R4-2408169 | CMCC | (NR\_MG\_enh2-Core) DraftCR on measurement delay for NFG (9.3.1, 9.3.9.1, 9.3.9.2, 9.3.9.4) |
| R4-2408432 | Qualcomm Incorporated | Draft CR for R18 inter-RAT measurement without gap (9.4.1, 9.4.8.1, 9.4.8.3.5, 9.4.8.4.5) |
| R4-2408486 | Intel Corporation | Maintenance CR on interruption requirements for measurements without gap (8.2.2.2.19) |
| R4-2409145 | Nokia | Draft CR 38.133 measurements without gaps (8.2.2.2.19, 9.2.1, 9.2.5, 9.3.1, 9.3.9.2) |
| R4-2409146 | Nokia | Draft CR 36.133 measurements without gaps (36.133 7.8.2.22) |
| R4-2409251 | Huawei | draftCR on requirements for inter-RAT LTE measurement without gap (9.4.8.2, 9.4.8.3.5, 9.4.8.4.5) |

**Issue CR-1: Maintenance CR on interruption requirements in TS 38.133 clause 8.2.2.19 (R4-2407347, R4-2408486, part of R4-2409145)**

* Recommended WF
	+ Merge overlapped CR-s to one.

**Issue CR-2: Maintenance CR on measurement requirements in TS 38.133 clause 9.2 and 9.3 (R4-2407831, R4-2408169, part of R4-2409145)**

* Recommended WF
	+ Merge overlapped CR-s to one.

**Issue CR-3: Maintenance CR on inter-RAT measurement requirements in TS 38.133 clause 9.4 (R4-2408432, R4-2409251)**

* Recommended WF
	+ Merge overlapped CR-s to one.

**Issue CR-4: Maintenance CR on TS 36.133 7.8.2.22 (R4-2407839, R4-2409146)**

* Recommended WF
	+ Merge overlapped CR-s to one.

# Topic #3: Performance part requirements for measurements without gap

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2407517 | CATT | Discussion on performance requirements for measurements without gaps**Observation 1: The issue regarding intra-frequency test configuration applies to both needforgap reporting (including with and without interruption) related and NCSG related test cases.** **Proposal 1: Option 3 can be one of the solutions to resolve the issue for intra-frequency test configuration.** **Proposal 2: For inter-frequency measurement test cases, discuss whether and how to guarantee the SSB of neighbor cell outside active BWP (e.g., adding a note).** **Proposal 3: For the measurement without gap without interruption, test both measurement delay and scheduling restriction in the same test. For the measurement without gap with interruption, test both measurement delay and interruption in the same test.** **Proposal 4: Define the following test cases for NeedForGaps reporting:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** |
| NFG1 | Event triggered reporting without gap with interruptions | Intra-frequency measurements  | FR1 | 20ms | Sub-test 1: No gap configSub-test 2: gap pattern #0 | No DRX |
| NFG2 | Intra-frequency measurements  | FR2 | 20ms | Sub-test 1: No gap configSub-test 2: gap pattern #13 | No DRX |
| NFG3 | Inter-frequency measurements  | FR1 | 20ms | Sub-test 1: No gap configSub-test 2: gap pattern #0 | No DRX  |
| NFG4 | Inter-frequency measurement | FR2 | 20ms | Sub-test 1: No gap configSub-test 2: gap pattern #13 | No DRX |
| NFG5 | Event triggered reporting without gap without interruption | Inter-frequency measurements  | FR1 | 20ms | No gap config | No DRX  |
| NFG6 | Inter-frequency measurements  | FR2 | 20ms | No gap config | No DRX  |
| NFG7 | Intra-frequency measurements  | FR1 | 20ms | No gap config | No DRX  |
| NFG8 | Intra-frequency measurements  | FR2 | 20ms | No gap config | No DRX  |

**Proposal 5: Define the following test cases for inter-RAT measurement:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW/SMTC configuration** | **MG configuration** | **DRX configuration** |
| ~~IR1~~ | Event triggered reporting without gap without interruption | ~~Inter-RAT EUTRAN measurements case b-1~~  | ~~NR FR1~~ | ~~Sub-test 1: 5ms~~~~Sub-test 2: 2ms~~ | ~~Sub-test 1: No gap config~~~~Sub-test 2: gap pattern #0~~ | ~~No DRX~~ |
| IR2 | Inter-RAT EUTRAN measurements case b-1  | NR FR1 | Sub-test 1: 5msSub-test 2: 2ms | Sub-test 1: No gap configSub-test 2: gap pattern #0 | No DRX  |
| IR3 | Inter-RAT EUTRAN measurements case b-2  | NR FR1 | Sub-test 1: 5msSub-test 2: 2ms | Sub-test 1: No gap configSub-test 2: gap pattern #0 | No DRX |
| IR4 | Inter-RAT NR measurements case a-1without interruption | NR FR1 | SMTC = 20ms | No gap config | No DRX |
| IR5 | Inter-RAT NR measurements case a-1 without interruption | NR FR2 | SMTC = 20ms | No gap config | No DRX |
| IR6 | Event triggered reporting without gap with interruptions | Inter-RAT NR measurements case a-1with interruption | NR FR1 | SMTC = 20ms | Sub-test 1: No gap configSub-test 2: gap pattern #0 | No DRX |
| IR7 | Inter-RAT NR measurements case a-1 with interruption | NR FR2 | SMTC = 160ms | Sub-test 1: No gap configSub-test 2: gap pattern #0 | No DRX |

 |
| R4-2408171 | CMCC | Discussion on RRM performance requirements for measurements without gaps***Proposal 1: for test cases on intra-frequency measurement without gap, it is proposed to use CSI-RS for L1 measurement, which is same as legacy test cases on intra-frequency measurement with gap.******Proposal 2: from test coverage point of view, it is proposed to define TC on NFG5, NFG6, NFG7, NFG8.*** ***Proposal 3: from test coverage point of view, it is proposed to define TC on IR1, IR2, IR3, IR4, IR5.******Proposal 4: it is proposed to test scheduling restrictions for case b-1 and b-2. But no new test cases is needed, it can be tested in the test configuration with mixed numerology, e.g. serving cell is LTE FDD/TDD and neighbour cell is NR with 30 kHz SSB SCS. And the test requirements are different for different UE capability. For UE capable of mixed numerology, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots. For UE not capable of mixed numerology, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the one where PDSCH or PUCCH is overlapped with the EMW.***  |
| R4-2408324 | Ericsson | Discussion on measurement without gaps test cases**Proposal 1: RAN4 to define intra-frequency wo gap test case in NeedForGaps and follow the legacy test case principle to use CSI-RS.**  |
| R4-2408622 | Vivo | On remaining issues for performance requirements for measurements without gaps**Proposal 1: Prefer to further reduce test case among 5-8, prefer to remove one test case between test case 6 and 8.** **Proposal 2: For intra-frequency measurement without gap, prefer to use the following “Follow the legacy TC principles: use CSI-RS but no need to support Option A and no requirements for CSI-RS measurements” as the principle for test case design.**  |
| R4-2409254 | Huawei | Discussion on test cases for measurement without MG**Proposal 1: Define NFG1 only if enhanced core requirements for DRX (no interruption during DRX on-duration) are agreed. Define NFG2-4.****Proposal 2: For Case a-1, define the same set of TCs as for NR measurement based on NFG. UE supporting both Case a-1 and R18 NFG only needs to pass one set of tests.****Proposal 3: For Case b-1 and b-2, define the separate set of TCs with same testing coverage. UE supporting both Case b-1 and b-2 only needs to pass one set of tests.****Proposal 4: For Case b-1 and b-2, agree on TC IR1 – IR6 with following updates.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW configuration** | **MG configuration** | **DRX configuration** | **Testing purpose** |
| **IR1** | **Event triggered reporting**  | **Inter-RAT EUTRAN measurements case b-1 without EMW or MG** | **NR FR1** |  **No EMW configuration** |  **No gap configuration** | **No DRX config** | **Measurement without EMW, when the measurement does not cause scheduling restriction.** |
| **IR2** | **Event triggered reporting** | **Inter-RAT EUTRAN measurements case b-1 without EMW but with MG**  | **NR FR1** |  **No EMW configuration** | **MG pattern #0** | **No DRX config** | **Measurement within MG, when the measurement causes scheduling restriction and EMW is not configured.** |
| **IR3** | **Event triggered reporting**  | **Inter-RAT EUTRAN measurements case b-1 with EMW but without MG**  | **NR FR1** |  **EMW pattern #0** | **No gap configuration** | **No DRX configuration** | **Measurement within EMW, when the measurement causes scheduling restriction and EMW is configured.** **EMW is dropped when colliding with SMTC** |
| **IR4** |  | **Same as IR1 but for Case b-2** |  |  |  |  |  |
| **IR5** |  | **Same as IR2 but for Case b-2** |  |  |  |  |  |
| **IR6** |  | **Same as IR3 but for Case b-2** |  |  |  |  |  |

 |
| R4-2408433 | Qualcomm | MG-Enh2-Perf remaining issues for part 2 perf requirements**Proposal : If RAN4 agreed to define the intra-frequency without gap but SSB outside of BWP test case, the following applicability rule should be applied :** **1) capable of both 'CSI-RS based RLM' and 'BWP without restriction,' or****2) capable of FG 53-4 (CSI-RS based L1) for Rel-18 WI of BWP without Restriction****Observation** : If DRX is configured, first UE cannot receive continuous data transmission; second if UE decode PDCCH the UE will wake up. Therefore, interruption ratio cannot properly calculate unlike to no-DRX test case.**Proposal : RAN4 do not define test with DRX configuration.**  |
| R4-2409147 | Nokia | Discussion on performance requirements for measurements without gaps**Proposal 1: Follow legacy approach for configuring RLM/RS for intra-frequency measurements without gaps with interruptions.****Observation 1: Interruptions during DRX ON have a significantly greater impact on UE throughput and latency performance compared to when DRX is not configured.****Proposal 2: Specify test cases with DRX and with non-DRX.****Proposal 3: Interruptions during test cases with DRX can be verified by scheduling the UE during the entire DRX period.****Proposal 4: When testing for interruptions, the entire on-duration period is considered, not stopped when activity timer starts.** |
| R4-2409748 | MTK | Discussion on RRM performance requirements for measurements without gaps **Proposal 1: RAN4 shall use CSI-RS for RLM measurements in the test cases for NeedForGap of intra-frequency measurements with SSB outside the active BWP but no need to support Option A and no requirements for CSI-RS measurements.** |

## Test cases for NFG

### Test cases list and responsibilities

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG1** | **Event triggered reporting and interruptions** | **Intra-frequency measurements without gap config but with DRX****Note: The testability needs to be checked before introducing the test case** | **FR1** | **20ms** | **No gap config** | **[DRX pattern TBD]** | **A.6.6.1.X** | **Nokia** |
| **NFG2** |  | **Intra-frequency measurements with~~out~~ gap configuration and ~~or~~ non-DRX configuration****The test purpose is: UE is not allowed to cause interruption outside measurement gap when SMTC partially overlaps with gap** | **FR2** | **~~160ms~~20ms** | **gap is configured****Note: UE can skip corresponding Rel-15 test cases** | **No DRX** | **A.7.6.1.X** | **Intel** |
| **NFG3** |  | **Inter-frequency measurements without gap and without DRX** | **All in FR1** | **20ms** | **No gap config** | **No DRX config** | **A.6.6.1.X** | **QC** |
| **NFG4** |  | **Inter-frequency measurements without gap config but without DRX****Note: The testability needs to be checked before introducing the test case** | **All in FR1** | **160ms** | **without gap** | **No DRX config** | **A.7.6.1.X** | **HW** |
| **NFG5** | **Event triggered reporting [without interruption]** | **Inter-frequency measurements without gap with non-DRX** | **All in FR1** | **20ms** | **No gap config** | **No DRX config** | **A.6.6.1.X** | **Ericsson** |
| **NFG6** |  | **Inter-frequency measurements without gap with non-DRX** | **All in FR2** | **20ms** | **No gap config** | **No DRX config** | **A.7.6.1.X** | **CATT** |
| **NFG7** |  | **Intra-frequency measurements without gap with non-DRX** | **FR1** | **20ms** | **No gap config** | **No DRX config** | **A.6.6.1.X** | **CMCC** |
| **NFG8** |  | **Intra-frequency measurements without gap** **with non-DRX** | **FR2** | **20ms** | **No gap config** | **No DRX config** | **A.7.6.1.X** | **MTK** |

* Previous agreements
	+ For all intra-freq without gap TC, companeis are encourage to check the testability, e.g., FFS L1 measurement configuration for active BWP not containing serving cell SSB.
	+ FFS whether to change the test case list remove TC among NFG5 to NFG8 will be confirmed in RAN4#111 meeting

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| R4-2409148 | Nokia | Draft CR TC for FR1 intra-freq measurments without gaps with interruptions (NFG1) |
| R4-2408487 | Intel | Test case for FR2 intra-frequency measurements for UE indicating NeedforInterruptionInfoNR under non-DRX and no interruption outside configured measurement gaps (NFG2) |
| R4-2408434 | Qualcomm | DraftCR TC FR1 inter-frequency measurement without gap with interruption (NFG3) |
| R4-2409255 | Huawei | draftCR on NFG TC4 (NFG4) |
| R4-2408325 | Ericsson | Draft CR to 38.133 Test Case of NFG TC5 (NFG5) |
| R4-2407515 | CATT | (NFG6) DraftCR on FR2 inter-frequency measurements without gap without interruption for needforgap reporting |
| R4-2408167 | CMCC | DraftCR on test case for intra-frequency measurement without gap without interruption and inter-RAT EUTRAN measurement case b-2 (NFG7) |
| R4-2409747 | MTK | Draft CR for test case of event triggered reporting without interruption Intra-frequency measurements without gap or DRX configuration (NFG8) |

This section is the place holder for comments on the test cases list NFG5 to NFG8. The companies are expected to provide comments only on the systematic test coverage and reduction of cases.

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| **Company** | **Comments** |
| Moderator | This section is the place holder for comments on the test cases list NFG5 to NFG8. Balance between test coverage and test cases number is considered by staggered configurations among SMTC, measurement gap, DRX, Frequency Range, and test scenarios (intra or inter frequency). |
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### Test cases details

**NFG1: R4-2409148**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG1** | **Event triggered reporting and interruptions** | **Intra-frequency measurements without gap config but with DRX****Note: The testability needs to be checked before introducing the test case** | **FR1** | **20ms** | **No gap config** | **Test 1: 320ms****Test 2: 20ms** | **A.6.5.2.X****A.6.6.1.X** | **Nokia** |

* Other proposals
	+ This test case requirements consist two test cases: one is in interruption clauses and the other is in measurement delay clauses.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**NFG2: R4-2408487**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG2** | **Event triggered reporting and interruptions** | **Intra-frequency measurements with gap configuration and non-DRX configuration****The test purpose is: UE is not allowed to cause interruption outside measurement gap when SMTC partially overlaps with gap** | **FR2** | **20ms periodicity** | **40ms MGRP** | **No DRX** | **A.7.6.1.X** | **Intel** |

* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**NFG3: R4-2408434**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG3** | **Event triggered reporting and interruptions** | **Inter-frequency measurements without gap and without DRX** | **All in FR1** | **20ms** | **No gap config** | **No DRX config** | **A.6.6.2.X** | **QC** |

* Other Proposals
	+ SSB time index detection is tested.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**NFG4: R4-2409255**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG4** | **Event triggered reporting and interruptions** | **Inter-frequency measurements without gap config but without DRX****Note: The testability needs to be checked before introducing the test case** | **All in FR1** | **160ms** | **No gap config** | **No DRX config** | **A.6.6.2.X** | **HW** |

* Other Proposals
	+ The TE schedules continuous DL data on PCell during the DRX ON duration. The parameter drx-LongCycleStartOffset is configured as {ms320, 10} such that measurement gap do not occur in DRX ON duration.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**NFG5: R4-2408325**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG5** | **Event triggered reporting without interruption** | **Inter-frequency measurements without gap with non-DRX** | **All in FR1** | **20ms** | **No gap config** | **No DRX config** | **A.6.6.X.Y** | **Ericsson** |

* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**NFG6: R4-2407515**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG6** | **Event triggered reporting [without interruption?]** | **Inter-frequency measurements without gap with non-DRX** | **All in FR2** | **20ms** | **No gap config** | **No DRX config** | **A.7.6.1.X** | **CATT** |

* Other Proposals
	+ During the T1 and T2, UE shall be able to report ACK/NACK for all slots with PDCCH/PDSCH on PCell excluding those symbles as defined in 9.3.9.4.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**NFG7: R4-2408167**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG7** | **Event triggered reporting without interruption** | **Intra-frequency measurements without gap or DRX configuration** | **FR1** | **20ms** | **No gap config** | **No DRX config** | **A.6.6.1.X** | **CMCC** |

* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**NFG8: R4-2409747**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **SMTC configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **NFG8** | **Event triggered reporting [without interruption?]** | **Intra-frequency measurements without gap or DRX configuration** | **FR2** | **20ms** | **No gap config** | **No DRX config** | **A.7.6.1.X** | **MTK** |

* Other Proposals
	+ CSI-RS.3.2 TDD resource #0 is configured for RLM.
	+ Interruption is not tested.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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## Test cases for inter-RAT

### Test cases list and responsibilities

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| **No.** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility** |
| **IR1** | **Event triggered reporting and interruptions** | **Inter-RAT EUTRAN measurements case b-1 with MG and DRX configuration** | **NR FR1** | **[Pattern TBD]** | **[Pattern TBD]** | **[DRX pattern TBD]** | **A.6.6.3.X** | **CATT** |
| **IR2** |  | **Inter-RAT EUTRAN measurements case b-1 with MG but no DRX configuration** | **NR FR1** | **[Pattern TBD]** | **[Pattern TBD]** | **No DRX config** | **A.6.6.3.X** | **xiaomi** |
| **IR3** | **Event triggered reporting [without interruption]** | **Inter-RAT EUTRAN measurements case b-2 without MG or DRX configuration** | **NR FR1** | **[Pattern TBD]** | **No gap configuration** | **No DRX configuration** | **A.6.6.3.X** | **CMCC** |
| **IR4** | **Event triggered reporting** | **Inter-RAT NR measurements case a-1with MG** | **NR FR2** | **No EMW config** | **[Pattern TBD]** | **No DRX config** | **A.8.4.2.X** | **HW** |
| **IR5** | **Event triggered reporting and interruptions** | **Inter-RAT NR measurements case a-1 with MG** | **NR FR1** | **No EMW config** | **[Pattern TBD]** | **No DRX config** | **A.8.4.2.X** | **Nokia** |

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| R4-2407516 | CATT | (IR1) DraftCR on inter-RAT EUTRAN measurements wihtout gap case b-1 |
| R4-2407832 | Xiaomi | [draftCR IR2] CR for inter-RAT EUTRAN measurements case b-2 without gap |
| R4-2408167 | CMCC | DraftCR on test case for intra-frequency measurement without gap without interruption and inter-RAT EUTRAN measurement case b-2 (IR3) |
| R4-2409256 | Huawei | draftCR on IR TC4 (IR4) |
| R4-2409149 | Nokia | Draf CR TC for inter-RAT NR measurements without gaps with interruption (IR5) |

This section is the place holder for comments on the test cases list. The companies are expected to provide comments only on the systematic test coverage and reduction of cases. A trade-off in test coverage and test time (number of tests and sub tests) is expected to be implemented according to the consensus of the group.

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| **Company** | **Comments** |
| Moderator | Balance between test coverage and test cases number is considered by staggered configurations among SMTC, measurement gap, DRX, Frequency Range, and test scenarios (intra or inter frequency). |
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### Test cases details

**IR1: R4-2407516**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **IR1** | **Event triggered reporting and interruptions** | **Inter-RAT EUTRAN measurements case b-1 with MG and DRX configuration** | **NR FR1** | **Pattern 0** | **No gap for subtest 1****GAP 0 for subtest 2** | **No DRX** | **A.6.6.3.X** | **CATT** |

* Other proposals
	+ EMW is configured as pattern 0.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**IR2: R4-2407832**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **IR2** | **Event triggered reporting and interruptions** | **Inter-RAT EUTRAN measurements case b-1 with MG but no DRX configuration** | **NR FR1** | **Pattern 0** | **No GAP configuration** | **No DRX config** | **A.6.6.3.X** | **xiaomi** |

* Other proposals
	+ The serving frequency and the target frequency should be selected such that UE reports [nogap-noncsg] for the target frequency given the serving frequency.
	+ EMW 0 is configured and no overlap is between EMW and SMTC.
	+ During T2, UE shall send HARQ-ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**IR3: R4-2408167**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **IR3** | **Event triggered reporting** **Interruption is tested** | **Inter-RAT EUTRAN measurements case b-2 without MG or DRX configuration** | **NR FR1** | **Pattern 0** | **No gap configuration** | **No DRX configuration** | **A.6.6.3.X** | **CMCC** |

* Other proposals
	+ EMW is configured as pattern 0.
	+ During T2, For configuration 3 and 6, for UE capable of [Simultaneous reception of NR data and EUTRAN CRS within BWP with different numerology], UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots. For UE not capable of [Simultaneous reception of NR data and EUTRAN CRS within BWP with different numerology], UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the EMW.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**IR4: R4-2409256**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **IR4** | **Event triggered reporting** | **Inter-RAT NR measurements case a-1with MG** | **NR FR2** | **No EMW configuration** | **No gap configuration** | **No DRX config** | **A.8.4.2.X** | **HW** |

* Other proposals
	+ No EMW is configured.
	+ SMTC periodicity is configured as 160ms.
	+ During the test, the interruption ratio (number of interrupted subframes over the number of total subframes) in LTE PCell shall be less than 1.25%, and each interruption shall not exceed 1 subframe.
* Recommended WF
	+ Discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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**IR5: R4-2409149**

* Test cases proposals:

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| **No. #** | **Item of core requirements** | **Type of test cases** | **Frequency range of serving cell** | **EMW configuration** | **MG configuration** | **DRX configuration** | **Subclause** | **Responsibility**  |
| **IR5** | **Event triggered reporting and interruptions** | **Inter-RAT NR measurements case a-1 with MG** | **NR FR1** | **No EMW config** | **No MG configuration** | **No DRX config** | **A.8.x.1 for Test 1****A.8.4.2.X for Test 2** | **Nokia** |

* Other proposals
	+ Two test cases are introduced: one for Interruption clauses and the other for measurement delay clauses.
* Recommended WF
	+ discuss upon the draftCR for test configurations related only to this case.

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| **Company** | **Comments** |
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