**3GPP TSG-RAN WG4 Meeting #112 R4-2411810**

**Maastricht, Netherlands, 19th – 23rd August, 2024**

**Agenda item:** 8.5.4

**Source:** Moderator (Huawei, HiSilicon)

**Title:** Topic summary for [112][215] NonCol\_intraB\_ENDC\_NR\_CA\_Ph2

**Document for:** Information

# Introduction

This email thread discusses the RRM core requirements of WI on R19 Support of intra-band non-collocated EN-DC/NR-CA deployment Phase2: new receiver type(s).

**Online handling**

(Online) Issue 1-1: MRTD and MTTD for Type 4 capable UE in non-collocated scenario

(Online) Issue 1-2: MRTD and MTTD for Type 4 capable UE in collocated scenario

(Online) Issue 1-5: Interruption requirements for Type 4 capable UE when UE operates with separate RF chain in non-collocated scenario

(Online) Issue 1-7: SCell activation delay requirements for Type 4 capable UE when UE operates with separate RF chain in non-collocated scenario

(Online) Issue 1-9: Scheduling availability for Type 4 capable UE when UE operates with separate RF chain in non-collocated scenario

*(Issue 1-5, 1-7, 1-9 are similar.)*

# Topic #1: RRM requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2411420 | Apple | Proposal 1: It is proposed to define MTTD requirement for type 4 UE as proposed in this section 2.1.  Proposal 2: It is proposed to define MRTD requirement for type 4 UE as proposed in this section 2.2.  Proposal 3: The legacy FR1 inter-band CA interruption requirements apply for type 4 UE in the aspects of interruption at SCell addition/release/activation/deactivation and interruption during measurements on deactivated SCC.  Proposal 4: The existing SCell activation delay requirements in clause 8.3.2 apply for type 4 UE if the values of TSMTC\_MAX and TFirstSSB\_MAX for FR1 inter-band CA SCell activation delay requirements is reused for FR1 intra-band non-contiguous CA.  Proposal 5: It is suggested that that Type 4 UE can be configured to perform beam failure detection on no more than 2 serving cells per band.  Proposal 6: Scheduling availability requirement should be introduced for type 4 UE performing beam failure detection with a different subcarrier spacing as PDSCH/PDCCH on FR1, L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1, measurement in TDD band, or measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1. |
| [R4-2411569](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411569.zip) | Nokia, Nokia Shanghai Bell | Observation #1: MRTD/MTTD requirements have nothing to do with the number of MIMO layers.  Proposal #1: For a Type 4 capable UE in non-collocated scenarios, the MRTD/MTTD requirements are the same as that for Type 2 UE.  Proposal #2: The MRTD/MTTD and the other RRM requirements need to be adapted based on the eventual UE type in operation which is indicated by the BS signaling.  Proposal #3: To wait for RF conclusion on the UE type transition before specifying the RRM requirements. |
| [R4-2412221](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412221.zip) | Huawei, HiSilicon | Proposal 1: R18 MRTD/MTTD requirements defined for Type 2 UE in non-co-located scenarios can be reused for Type 4 capable FWA UE, that is  - MRTD/MTTD requirements for non-collocated FR1 inter-band synchronous EN-DC with overlapping DL bands for Type 4 UE are  • MRTD=33us  • MTTD=35.21us  - MRTD/MTTD requirements for non-collocated FR1 intra-band non-contiguous NR-CA for Type 4 UE are  • MRTD=33us  • MTTD=34.6us  Proposal 2: The following principle is supposed to be followed:  • when UE operates with separate RF chain (in “ Type 4” or “ Type4 fall back to Type 2 (not decided yet)”) in non-collocated scenario, the requirements (including scheduling restriction, interruption, SCell activation delay) defined for type 2 UE in non-collocated scenario in R18 can be applied;  • when UE operates with shared RF chains (“ fall back to Type 1 with 4 Rx(not decided yet)” or “fall back to Type 1 with 8 Rx”) in collocated scenario, the requirements (including scheduling restriction, interruption, SCell activation delay) defined for type 2 UE in collocated scenario in R18 can be applied.  Proposal 3: Type 4 UE when operating in non-collocated scenario can be configured with BFD/CBD measurements on up to two serving cells in the same band.  Proposal 4: For type 4 UE fallback between non-collocated scenario and collocated scenario, either a new BS signalling (e.g., nonCollocatedTypeNR-CA-r19) or extend existing nonCollocatedTypeNR-CA-r18 to make it applicable for UEs configured with maxMIMO-Layers ≤ 4 can work. RAN2 can decide which scheme shall be adopted.  Observation 1: In non-collocated scenario, Type 4 UE falling back to Type 2 capability is not very necessary.  Observation 2: Type 4 UE can fall back to Type 2 UE through BWP switch procedure which is supported in R16, if falling back to Type 2 is needed.  Proposal 5: In non-collocated scenario, UE is operating with separate chains (Type 4 or Type 2 UE). There is no need to introduce additional new BS signalling to enable Type 4 UE fallback to Type 2 UE.  Proposal 6: In collocated scenario, UE is operating with shared chains (Type 1 with 4 Rx or Type 1 with 8RX). There is no need to introduce additional new BS signalling to distinguish Type 4 UE fallback to “Type 1 with 4RX” or “Type 1 with 8RX”. |
| [R4-2412388](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412388.zip) | ZTE Corporation, Sanechips | Proposal 1: For 4 layer MIMO case, the existing MRTD/MTTD requirements defined in 38.133 for inter-band case can be reused for intra-band EN-DC/NR-CA in non-collocated deployment.  Observation1: If MRTD requirement can be reused for Type 4 UE, the current SCell activation delay requirements for FR1 intra-band non-collocated non-contiguous CA for Type 2 UE and FR1 inter-band CA can also be applied for FR1 intra-band non-collocated non-contiguous CA for Type 4 UE.  Proposal 2: The existing interruptions requirements as SCell addition/release/ activation/deactivation in FR1 for FR1 inter-band CA can be applied for FR1 intra-band non-contiguous CA supporting non-collocated deployment for 4-layer MIMO case.  Proposal 3: It is suggested that Type 4 UE can be configured with BFD/CBD measurements on more than one serving cells in the same band.  Proposal 4: For Type 4 UE with FR1 intra-band CA, there are no scheduling restrictions on carriers in the same band. |
| [R4-2412849](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412849.zip) | Ericsson | Observation 1: In 3GPP Release-18 Support of intra-band non-collocated EN-DC/NR-CA deployment we have the following requirements regarding MRTD and MTTD:   |  |  |  | | --- | --- | --- | | Feature | MRTD (µs) | MTTD (µs) | | EN-DC | 33 | 35.21 | | CA | 33 | 34.6 |   Observation 2: The deployment considerations for the operators will not change from rel-18 to release-19.  Proposal 1: Reuse MRTD and MTTD for intra-band non-collocated EN-DC/NR-CA rel-18, also for release-19, i.e., ED-DC: MRTD = 33 µs, MTTD = 35.21 µs and CA: MRTD = 33 µs, MTTD = 34.6 µs  Observation 3: We still have the same 2 CC non-colocated case in release 19, as in release 18. The only difference is that we had RANK2 MIMO per CC in release-18 and we have up to RANK 4 MIMO per CC in release-19.  Proposal 2: The development for release-19 non-colocated intra band ENDC and NRCA requirements can use release-18 Scheduling restriction/availability, SCell operation related delay and interruptions as starting points for analysis. |
| [R4-2412854](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412854.zip) | Samsung, KDDI | Observation 1: In Rel-18,   * For FR1 intra-band non-contiguous synchronous NR-CA Type 2 UE in non-collocated deployment:   MRTD=33us and MTTD=34.6us   * For FR1 intra-band asynchronous NR-CA Type 2 UE in non-collocated deployment: No MRTD/MTTD requirement was introduced * For FR1 inter-band synchronous EN-DC Type 2 UE in non-collocated deployment: MRTD=33us and MTTD=35.21us   Observation 2: In Rel-18,   * The new capability requirementTypeIndication-r18 was introduced for the UE supporting TDD-TDD inter-band EN-DC with overlapping DL bands to indicate whether it supports reconfigure to type 1 with the new BS signalling nonCollocatedTypeMRDC-r18   + - For the UE supporting both interBandMRDC-WithOverlapDL-Bands-r16 and requirementTypeIndication-r18, it needs to satisfy both type 1 requirement and type 2 requirement, of which type 2 requirement is the default behaviour     - Type 1 requirement applies if nonCollocatedTypeMRDC-r18 is indicated   Observation 3: In Rel-18,   * For the UE supporting intraBandNR-CA-non-collocated-r18, it needs to satisfy both type 1 requirement and type 2 requirement, of which type 2 requirement is the default behaviour   + - Type 1 requirement apply if nonCollocatedTypeNR-CA is indicated   Observation 4: In RF, it was agreed that Type 4 reuses the Type 2 RF requirements  Observation 5: The UE RF architecture of intra-band non-collocated non-contiguous NR-CA type 2 is 2 layer/2 Rx Chain per CC, total 4 Rx Chain  Observation 6: By comparing the RF architectures between type 2 and type 4, the main difference is the supported MIMO layers per CC  Proposal 1: For non-collocated FR1 intra-band non-contiguous synchronous NR-CA Type 4 UE, the same MRTD/MTTD requirements as Type 2 UE can be reused  Proposal 2: Not to introduce MRTD/MTTD requirements for non-collocated FR1 intra-band asynchronous NR-CA for Type 4 UE in Rel-19  Proposal 3: The impact on the following RRM requirements for type 4 UE can be the same as for type 2 UE   * Scheduling restriction * Interruption * SCell activation delay * SSB/CSI-RS based BFD * SSB/CSI-RS based CBD   Proposal 4: How to specify the impacted RRM requirements for Rel-19 type 4 UE need to wait for RF progress on the design of new UE capabilities/NW signallings |
| R4-2411421 | Apple | draft CR on RRM requirement update for type 4 UE |

## Open issues summary

### Sub-topic 1: RRM requirements impact

**(Online) Issue 1-1: MRTD and MTTD for Type 4 capable UE in non-collocated scenario**

* Proposals
  + Option 1(Apple, Nokia, Huawei, ZTE, Ericsson, Samsung, KDDI): R18 MRTD/MTTD requirements defined for Type 2 UE in non-collocated scenarios can be reused for Type 4 capable UE in non-collocated scenarios, that is

- non-collocated FR1 inter-band synchronous EN-DC with overlapping DL bands for Type 4 UE,

• MRTD=33us (Table 7.6.2.1-1)

• MTTD=35.21us (Table 7.5.2.1-1)

- non-collocated FR1 intra-band non-contiguous NR-CA for Type 4 UE,

• MRTD=33us (Table 7.6.4-2)

• MTTD=34.6us (Table 7.5.4-1)

* Recommended WF

Further discussion.

**(Online) Issue 1-2: MRTD and MTTD for Type 4 capable UE in collocated scenario**

* Proposals
  + Option 1(Apple): R18 MRTD/MTTD requirements defined for Type 2 UE in collocated scenario can be reused for Type 4 capable UE in collocated scenario, that is

- for Type 4 UE non-collocated FR1 inter-band synchronous EN-DC with overlapping DL bands in collocated scenario,

• MRTD=3us (Table 7.6.3-1)

• MTTD=5.21us (Table 7.5.3-1)

- for Type 4 UE non-collocated FR1 intra-band non-contiguous NR-CA,

• MRTD=3us (Table 7.6.4-1)

* + Option 2 (Nokia): The MRTD/MTTD need to be adapted based on the eventual UE type in operation which is indicated by the BS signaling. To wait for RF conclusion on the UE type transition before specifying the RRM requirements
* Recommended WF

Further discussion.

**Issue 1-3: Whether to introduce MRTD/MTTD requirements for non-collocated FR1 intra-band asynchronous NR-CA for Type 4 UE in Rel-19**

* Proposals
  + Option 1(Samsung, KDDI): Not to introduce MRTD/MTTD requirements for non-collocated FR1 intra-band asynchronous NR-CA for Type 4 UE in Rel-19.
* Recommended WF

Further discussion.

**Issue 1-4: Other RRM requirements (apart from MRTD/MTTD requirements) for Type 4 UE**

* Proposals
  + Option 1(Apple, Nokia, Huawei, ZTE, Ericsson, Samsung, KDDI): The following RRM requirements (apart from MRTD/MTTD requirements) are also impacted due to Type 4 UE
* Interruption
* SCell activation delay
* Scheduling availability
* SSB based and CSI-RS based BFD (Beam failure detection) and CBD (candidate beam detection)
* Recommended WF

Further discussion.

**(Online) Issue 1-5: Interruption requirements for Type 4 capable UE when UE operates with separate RF chain in non-collocated scenario**

* Proposals
  + Option 1(Apple, Huawei, ZTE, Ericsson, Samsung, KDDI): When Type 4 capable UE operates with separate RF chain in non-collocated scenario, interruption requirements (below listed) defined for type 2 UE in non-collocated scenario in R18 can be applied
* Interruption at SCell addition/release
* Interruptions at SCell activation/deactivation
* Interruptions during measurements on deactivated SCC
* Recommended WF

Further discussion.

**Issue 1-6: Interruption requirements for Type 4 capable UE when UE operates with shared RF chains in collocated scenario**

* Proposals
  + Option 1(Apple, Huawei): when Type 4 capable UE operates with shared RF chains in collocated scenario, interruption requirements (below listed) defined for type 2 UE in collocated scenario in R18 can be applied
* Interruption at SCell addition/release
* Interruptions at SCell activation/deactivation
* Interruptions during measurements on deactivated SCC

*Note: Some clarifications are needed with regard to the UE capability reporting signalling and network indication*

* + Option 2 (Nokia, Samsung, KDDI): wait for RF progress on UE type transition and design of new UE capabilities/NW signalling.
* Recommended WF

Further discussion.

**(Online) Issue 1-7: SCell activation delay requirements for Type 4 capable UE when UE operates with separate RF chain in non-collocated scenario**

* Proposals
  + Option 1(Apple, Huawei, ZTE, Ericsson, Samsung, KDDI): When Type 4 capable UE operates with separate RF chain in non-collocated scenario, SCell activation delay defined for type 2 UE in non-collocated scenario in R18 can be applied.
* Recommended WF

Further discussion.

**Issue 1-8: SCell activation delay requirements for Type 4 capable UE when UE operates with shared RF chains in collocated scenario**

* Proposals
  + Option 1(Apple, Huawei): When Type 4 capable UE operates with shared RF chain in collocated scenario, SCell activation delay defined for type 2 UE in collocated scenario in R18 can be applied.

*Note: Some clarifications are needed with regard to the UE capability reporting signalling and network indication*

* + Option 2 (Nokia, Samsung, KDDI): wait for RF progress on UE type transition and design of new UE capabilities/NW signalling.
* Recommended WF

Further discussion.

**(Online) Issue 1-9: Scheduling availability for Type 4 capable UE when UE operates with separate RF chain in non-collocated scenario**

* Proposals
  + Option 1(Apple, Huawei, ZTE, Ericsson, Samsung, KDDI): When type 4 capable UE operates with separate RF chain in non-collocated scenario, scheduling availability defined for type 2 UE in non-collocated scenario in R18 can be applied
* Recommended WF

Further discussion.

**Issue 1-10: Scheduling availability for Type 4 capable UE when UE operates with shared RF chain in collocated scenario**

* Proposals
  + Option 1(Apple, Huawei): When type 4 capable UE operates with shared RF chain in collocated scenario, scheduling availability defined for type 2 UE in collocated scenario in R18 can be applied

*Note: Some clarifications are needed with regard to the UE capability reporting signalling and network indication*

* + Option 2 (Nokia, Samsung, KDDI): wait for RF progress on UE type transition and design of new UE capabilities/NW signalling.
* Recommended WF

Further discussion.

**Issue 1-11: SCell BFD/CBD requirements for Type 4 capable UE**

* Proposals
  + Option 1(Apple, Huawei, ZTE): Type 4 capable UE when operating in non-collocated scenario can be configured with BFD/CBD measurements on up to two serving cells per band.
* Recommended WF

Further discussion.

### Sub-topic 2: UE Capability/UE behavior and network signaling for Type 4 EN-DC/NR-CA

**Issue 2-1: Whether to introduce new BS signalling for type 4 UE fallback between non-collocated scenario and collocated scenario**

* Proposals
  + Option 1(Huawei): For type 4 UE fallback between non-collocated scenario and collocated scenario, either a new BS signalling (e.g., *nonCollocatedTypeNR-CA-r19*) or extend existing *nonCollocatedTypeNR-CA-r18* to make it applicable for UEs configured with maxMIMO-Layers ≤ 4 can work. RAN2 can decide which scheme shall be adopted.
* Recommended WF

No discussion in RRM session and wait for conclusion/ progress in RF session, as there is a parallel discussion in RF session.

**Issue 2-2: Whether to introduce additional new BS signalling to enable Type 4 UE fallback to Type 2 UE in non-collocated scenario**

* Proposals
  + Option 1(Huawei): In non-collocated scenario, UE is operating with separate chains (Type 4 or Type 2 UE). There is no need to introduce additional new BS signalling to enable Type 4 UE fallback to Type 2 UE.
* Recommended WF

No discussion in RRM session and wait for conclusion/ progress in RF session, as there is a parallel discussion in RF session.

**Issue 2-3: Whether to introduce additional new BS signalling to distinguish Type 4 UE fallback to “Type 1 with 4RX” or “Type 1 with 8RX” in collocated scenario**

* Proposals
  + Option 1(Huawei): In collocated scenario, UE is operating with shared chains (Type 1 with 4 Rx or Type 1 with 8RX). There is no need to introduce additional new BS signalling to distinguish Type 4 UE fallback to “Type 1 with 4RX” or “Type 1 with 8RX”.
* Recommended WF

No discussion in RRM session and wait for conclusion/ progress in RF session, as there is a parallel discussion in RF session.