**3GPP TSG-RAN WG4 Meeting #112 R4-2412826**

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

**Agenda item:** 8.5.4

**Source:** Moderator **(**KDDI)

**Title:** Topic summary for [112][124] NonCol\_intraB\_ENDC\_NR\_CA

**Document for:** Information

# Introduction

This part includes contributions in agenda 5.7 of Rel-18, 8.5.1 and 8.5.2 of Rel-19. On the other hand, Rel-18 two RRM CRs will be treated in RRM session as [112][202] Maintenance\_R18.

# Topic #1: Rel-18 Type 2

## Sub-topic 1-1 : UE RF requirements for Type 2 EN-DC/NR-CA

### Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc#** | **Company** | **Proposals / Observations** |
| R4-2411413 | Apple | ***Observation:*** The in-GAP signal from another operator will largely impact whether the reconfiguration can be done correctly.***Proposal:*** RAN4 discuss and confirm whether and how to factor in the in-GAP interference impact on type 2 UE reconfiguration. |
|  |  |  |

### Open issues summary

*Sub-topic description:*

R4-2411413(Apple) propose to discuss and confirm whether and how to factor in the in-GAP interference impact on type 2 UE reconfiguration. On the other hand, it seems to be discussed in Rel-19 Fragmented Carrier WI in parallel.

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1: In-GAP interference impact on Type 2 UE reconfiguration**

* Proposals
	+ Option 1: (Apple)

RAN4 discuss and confirm whether and how to factor in the in-GAP interference impact on Type 2 UE reconfiguration.

* + Option 2: (Moderator)

To avoid duplicated discussion, RAN4 discuss and confirm whether and how to factor in the in-GAP interference impact on Type 2 UE reconfiguration in [112][125] FS\_NR\_DL\_Frag\_Carrier.

* Recommended WF
	+ Collect companies’ views.

## CRs for 38.101-1

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc**  | **Company** | **Title/Comments** | **Recommendation** |
| R4-2411997Rel-18CAT-F: | Nokia, Samsung | CR 38.101-1 Clarifications for non-collocated requirements *Moderator’s note: This CR is**1. Some furter refinement based on CR R4-2410737(agreed on RAN4#111) is present for clause 7.1,* *2. Modify “Rx requirements” to “power imbalance” and refine the sentence in clause 7.10B.3**3. Notes in configurations tables are very hard to understand.* | *This CR needs to be merged with R4-2412382.* |
| R4-2412382Rel-18CAT-F: | Huawei, Hisilicon | (NonCol\_intraB\_ENDC\_NR\_CA-Core) Specifying different intra-band non-contiguous CA UE capability types*Moderator’s note:**This CR is to increase the readibility and understanding of the requirements we propose to introduce multiple intra-band non-contiguous CA UE capability types, for colocated and non-collocated deployment scenarios* | *This CR needs to be merged with R4-2411997.* |
|  |  |  |  |

## CRs for 38.101-3

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc**  | **Company** | **Title/Comments** | **Recommendation** |
| R4-2411996Rel-18CAT-F: | Nokia, Samsung | CR 38.101-3 Clarifications for non-collocated requirements*Moderator’s note: This CR is* *1. Some furter refinement based on CR R4-2410737(agreed on RAN4#111) is present for clause 7.1,* *2. Modify “Rx requirements” to “power imbalance” and refine the sentence in clause 7.10B.3**3. Notes in configurations tables are very hard to understand* | *This CR needs to be merged with R4-2412383.* |
|  |  |  |  |
| R4-2412383Rel-18CAT-F: | Huawei, Hisilicon | (NonCol\_intraB\_ENDC\_NR\_CA-Core) Specifying different intra-band non-contiguous CA UE capability types*Moderator’s note:**This CR is to increase the readibility and understanding of the requirements we propose to introduce multiple intra-band non-contiguous CA UE capability types, for colocated and non-collocated deployment scenarios* | *This CR needs to be merged with R4-2411996.* |
|  |  |  |  |
|  |  |  |  |

# Topic #2: Rel-19 Type 4

## Sub-topic 2-1 : Rel-19 Revised WID for Type 4 EN-DC/NR-CA

### Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc**  | **Company** | **Title/Comments** | **Recommendation** |
| R4-2411288 | KDDI | Revised WID on Support of intra-band non-collocated EN-DC/NR-CA deployment Phase2: new receiver type(s) |  |

### Open issues summary

*Sub-topic description:*

R4-2411288 (KDDI) proposes to revised Rel-19 WID to clarify the max number of CCs for Type 4 EN-DC/NR-CA.

*Open issues and candidate options before e-meeting:*

**Issue 2-1: Revised WID for Type 4**

* Proposal
	+ Agree with revised WID to clarify the max number of CCs for Type 4 EN-DC/NR-CA.
* Recommended WF
	+ Collect companies’ views.

Agreement: RAN4 suggests to revise WID to clarify the max number of CCs for Type 4 EN-DC/NR-CA.

## Sub-topic 2-2 : UE RF requirements for Type 4 EN-DC/NR-CA

### Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc#** | **Company** | **Proposals / Observations** |
| R4-2411414 | Apple | ***Proposal 1:*** decide between Option 1 and Option 2 on how to capture power imbalance requirement for type 4 UE.***Proposal 2:*** it is proposed that center of BWanother relative to edge of BWwanted is assumed to be at least 80MHz+BWanother/2 away from the edge of the wanted CC.***Proposal 3:*** Requirement applicability rules for type 4 UE,* For capability set 1 capable UE, it should be verified with power imbalance requirement for type 4 UE in 7.10A and 4Rx RF requirements for intra-band non-contiguous CA in 7.4A.2~7.8A.2.
* For capability set 1&2 capable UE, it should be verified with power imbalance requirement for type 4 UE in 7.10A and 8Rx RF requirements for intra-band non-contiguous CA in 7.4A.2~7.8A.2.
 |
| R4-2411892 | ZTE Corporation, Sanechips | ***Proposal 1.*** To take the following modification of 7.10A into consideration for power imbalance of type 4 NRCA.

|  |
| --- |
| 7.10A.1 GeneralPower imbalance requirement is a measure of the receiver’s ability to receive a wanted signal in the presence of another signal with a power imbalance and a specific frequency offset from the wanted signal. Power imbalance requirement in this subclause is only applicable for a UE whenA UE capable of *intraBandNR-CA-non-collocated-r18* and is not provided with *nonCollocatedTypeNR-CA-r18* and is configured with *maxMIMO-Layers* with value less than or equal to 2*.*Or a UE capable of [*intraBandNR-CA-non-collocated-r19]* and is not provided with *[nonCollocatedTypeNR-CA-r19]* and is configured with *maxMIMO-Layers* with value less than or equal to 4*.* |

Table 7.10A.2-1: Power imbalance parameters for intra-band non-contiguous CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test configurations | Carriers | Rx Power in transmission bandwidth configuration (dBm) | channel bandwidth | Center of BWanother Relative to edge of BWwanted |
| 1 | Wanted carrier | REFSENS NOTE 4 + 1 | BWwanted ≤ BWanother | < max (5/2\* BWanother, 50MHz |
| Another wanted carrier  | Power of wanted carrier + 25 |
| 2 | Wanted carrier | REFSENS NOTE 4 + 1 | BWwanted > BWanother |
| Another wanted carrier | Power of wanted carrier + 25 – 10\*log10(BWwanted /BWanother) |
| 3 | Wanted carrier | REFSENS NOTE 4 + 1 | NA | ≥ max (5/2\* BWanother, 50MHz) |
| Another wanted carrier  | Power of wanted carrier + 25 |
| NOTE 1: The transmitter shall be set to 24dB below PCMAX\_L,f,c at the minimum uplink configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c as defined in clause 6.2A.4.NOTE 2: BWwanted is the channel bandwidth of wanted carrier. BWanother is the channel bandwidth of another wanted carrier with 25 dB power imbalance.NOTE 3: It’s allowed to use one of test configurations to verify the RX power imbalance requirement.NOTE 4: REFSENS is the reference sensitivity level for two antenna port in Table 7.3.2-1b and/or for four antenna port in Table 7.3.2-1b modified by the ΔRIB,4R in Table 7.3.2-2. |

***Proposal 2.*** Not to consider additional minimum DL frequency separation in RAN4 specification for type 4a/4b UE. The minimum separation applicable to type2 in RAN4 specification also applies to type4a/4b. |
| R4-2411892 | Huawei, HiSilicon | ***Proposal 1:*** Center of BWanother relative to edge of BWwanted is assumed to be at least 80MHz+BWanother/2 away from the edge of the wanted CC.***Proposal 2:*** For a type 4 UE, no minimum or maximum DL separation is needed to be specified in RAN4, as it was the case for type 2 UEs. |
| R4-2412512 | NTT DOCOMO INC. | ***Observation 1:*** Option 2 seems to preclude multiple scenarios that are likely to be used based on the frequency allocation.***Observation 2:*** In Rel-18 discussion, agreement on minimum DL frequency separation is not reflected in RAN4 specification, but instead it would be considered in the test setup of RAN5.***Observation 3:*** As for the origin of Option 2, it seems to come from the description of requirements currently defined in TS 38.101-3.***Proposal:*** Take option 1 for Minimum DL frequency separation for UE RF requirement type 4 EN-DC/NR CA.* Option 1. Center of BWanother relative to edge of BWwanted is assumed to be at least 80MHz+BWanother/2 away from the edge of the wanted CC.
* Note:
	+ Above agreement on minimum DL frequency separation will not be reflected in RAN4 specification. Any DL frequency separation is assumed in terms of core specification.
	+ RAN4 sends an LS to ask RAN5 to consider the agreement on minimum DL frequency separation for the test condition in RAN5.
 |
| R4-2412612 | Qualcomm | ***Proposal 1****:* For Minimum DL frequency separation, choose Option 1. |
| R4-2412730 | OPPO | ***Proposal 1*:** To capture the type 4 UE RF requirement, current note3 in table 7.10A.2-1 needs to update with both type 2 and type 4 but not directly use the terminology of “type 2” and “type 4”.***Proposal 2*:** To capture the type 4 UE RF requirement, current note 4 in table 7.10A.2-1 needs to update with the ΔRIB,4R in table 7.3.2-2 to consider the 4RX REFSENS.***Proposal 3:***for type 4a UE, the component carrier configured with 2 layers should fulfil 2RX requirement while the component carrier configured with 4 layers should fulfil 4RX requirement.***Proposal 4:*** For type 4b UE. 4RX requirement apply for each component carrier.***Proposal 5:*** The min DL separation is proposed as Max (5/2\* BWanother, [50] MHz). There is no need to further capture this in the specification. |
| R4-2412847 | Ericsson | ***Observation 1:*** “Center of BWanother relative to edge of BWwanted is assumed to be at least 80MHz+BWanother/2 away from the edge of the wanted CC”, is fine, since this is the particular case in this WI. |

### Open issues summary

*Sub-topic description:*

R4-2411414(Apple) proposes to discuss directions on how to the power imbalance and REFSENS requirements, and also R4-2411892(ZTE) and R4-2412730(OPPO) propose to specifically update the requirements of Table 7.10A.2-1.

*Open issues and candidate options before e-meeting:*

**Issue 2-2-1: How to capture the power imbalance and REFSENS requirements**

* Proposals
	+ Option 1: (Apple)

Decide between Option 1-1 and 1-2 on how to capture power imbalance requirement for type 4 UE.

* Option 1-1: Adding NOTE 6 in Table 7.10A.2-1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test configurations | Carriers | Rx Power in transmission bandwidth configuration (dBm) | channel bandwidth | Center of BWanother Relative to edge of BWwanted |
| 1 | Wanted carrier | REFSENS NOTE 4 + 1 | BWwanted ≤ BWanother | < max (5/2\* BWanother, 50MHz |
| Another wanted carrier  | Power of wanted carrier + 25 |
| 2 | Wanted carrier | REFSENS NOTE 4 + 1 | BWwanted > BWanother |
| Another wanted carrier | Power of wanted carrier + 25 – 10\*log10(BWwanted /BWanother) |
| 3 | Wanted carrier | REFSENS NOTE 4 + 1 | NA | ≥ max (5/2\* BWanother, 50MHz) |
| Another wanted carrier  | Power of wanted carrier + 25 |
| NOTE 1: The transmitter shall be set to 24dB below PCMAX\_L,f,c at the minimum uplink configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c as defined in clause 6.2A.4.NOTE 2: BWwanted is the channel bandwidth of wanted carrier. BWanother is the channel bandwidth of another wanted carrier with 25 dB power imbalance.NOTE 3: It’s allowed to use one of test configurations to verify the RX power imbalance requirement for type 2 UE.NOTE 4: For UE indicating *intraBandNR-CA-non-collocated-r18,* REFSENS is the reference sensitivity level for two antenna port in Table 7.3.2-1b. For UE indicating [*intraBandNR-CA-non-collocatedType4-r19,* REFSENS is the reference sensitivity level for four antenna port which is specified as the value in Table 7.3.2-1b modified by the amount ΔRIB,4R in Table 7.3.2-2.NOTE 5: Void. |

* Option 1-2: Specified different Rx power for type 2 and type 4 UE.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test configurations | Carriers | Rx Power in transmission bandwidth configuration (dBm) | channel bandwidth | Center of BWanother Relative to edge of BWwanted |
| 1 | Wanted carrier for type 2 UE | REFSENS NOTE 4 + 1 | BWwanted ≤ BWanother | < max (5/2\* BWanother, 50MHz |
| Wanted carrier for type 4 UE | REFSENS NOTE 4 + ΔRIB,4RNOTE 6 1 |
| Another wanted carrier  | Power of wanted carrier + 25 |
| 2 | Wanted carrier for type 2 UE | REFSENS NOTE 4 + 1 | BWwanted > BWanother |
| Wanted carrier for type 4 UE | REFSENS NOTE 4 + ΔRIB,4RNOTE 6 1 |
| Another wanted carrier | Power of wanted carrier + 25 – 10\*log10(BWwanted /BWanother) |
| 3 | Wanted carrier for type 2 UE | REFSENS NOTE 4 + 1 | NA | ≥ max (5/2\* BWanother, 50MHz) |
| Wanted carrier for type 4 UE | REFSENS NOTE 4 + ΔRIB,4RNOTE 6 1 |
| Another wanted carrier  | Power of wanted carrier + 25 |
| NOTE 1: The transmitter shall be set to 24dB below PCMAX\_L,f,c at the minimum uplink configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c as defined in clause 6.2A.4.NOTE 2: BWwanted is the channel bandwidth of wanted carrier. BWanother is the channel bandwidth of another wanted carrier with 25 dB power imbalance.NOTE 3: It’s allowed to use one of test configurations to verify the RX power imbalance requirement for type 2 UE.NOTE 4: REFSENS is the reference sensitivity level for two antenna port in Table 7.3.2-1b. NOTE 5: Void.NOTE 6: ΔRIB,4R is the reference sensitivity allowance as specified in Table 7.3.2-2. |

* + Option 2: (ZTE)

Take the following modification of 7.10A into consideration for power imbalance of type 4 NRCA.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test configurations | Carriers | Rx Power in transmission bandwidth configuration (dBm) | channel bandwidth | Center of BWanother Relative to edge of BWwanted |
| 1 | Wanted carrier | REFSENS NOTE 4 + 1 | BWwanted ≤ BWanother | < max (5/2\* BWanother, 50MHz |
| Another wanted carrier  | Power of wanted carrier + 25 |
| 2 | Wanted carrier | REFSENS NOTE 4 + 1 | BWwanted > BWanother |
| Another wanted carrier | Power of wanted carrier + 25 – 10\*log10(BWwanted /BWanother) |
| 3 | Wanted carrier | REFSENS NOTE 4 + 1 | NA | ≥ max (5/2\* BWanother, 50MHz) |
| Another wanted carrier  | Power of wanted carrier + 25 |
| NOTE 1: The transmitter shall be set to 24dB below PCMAX\_L,f,c at the minimum uplink configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c as defined in clause 6.2A.4.NOTE 2: BWwanted is the channel bandwidth of wanted carrier. BWanother is the channel bandwidth of another wanted carrier with 25 dB power imbalance.NOTE 3: It’s allowed to use one of test configurations to verify the RX power imbalance requirement.NOTE 4: REFSENS is the reference sensitivity level for two antenna port in Table 7.3.2-1b and/or for four antenna port in Table 7.3.2-1b modified by the ΔRIB,4R in Table 7.3.2-2. |

* + Option 3: (OPPO)

Proposal 1: To capture the type 4 UE RF requirement, current note3 in table 7.10A.2-1 needs to update with both type 2 and type 4 but not directly use the terminology of “type 2” and “type 4”.

Proposal 2: To capture the type 4 UE RF requirement, current note 4 in table 7.10A.2-1 needs to update with the ΔRIB,4R in table 7.3.2-2 to consider the 4RX REFSENS.

Proposal 3: for type 4a UE, the component carrier configured with 2 layers should fulfil 2RX requirement while the component carrier configured with 4 layers should fulfil 4RX requirement.

Proposal 4: For type 4b UE. 4RX requirement apply for each component carrier.

* Recommended WF
	+ Before jumping to details of UE RF description, discuss following directions on how to capture the power imbalance and REFSENS requirements.

Option 1-1: Adding Note 6 in Table 7.10A.2-1.

Option 1-2: Specified different Rx power for Type 2 and Type 4 UE in Table 7.10A.2-1.

* + Except for directions as mentioned above, wait for a conclusion of Rel-18 CRs related discussions (see section 1.2 and 1.3) to avoid duplicated discussions.

Samsung: We prefer option 1-1. Regarding the details of note, we can further check it. We can consider ZTE proposed note.

OPPO: agree on option 1-2.

Qualcomm: no rush to make decision on writing the CR.

Huawei: agree with Qualcomm. Note 4 is fine. Some wording needs be modified. Better to discuss it for big CR.

*Sub-topic description:*

R4-2411415(Apple), R4-2412431(Huawei), R4-2412512(Docomo) and R4-2412612(Qualcomm) propose to assume that center of BWanother relative to edge of BWwanted is at least 80MHz+BWanother/2 away from the edge of the wanted CC. And also, R4-2411892(ZTE) also propose not to consider additional minimum DL frequency separation in RAN4 specification for type 4a/4b UE. The minimum separation applicable to type2 in RAN4 specification also applies to type4a/4b. And R4-2412730(OPPO) proposes the min DL separation is proposed as Max (5/2\* BWanother, [50] MHz). There is no need to further capture this in the specification

*Open issues and candidate options before e-meeting:*

**Issue 2-2-2: Minimum DL frequency separation**

* Proposals
	+ Option 1: (Apple/Huawei/Docomo/Qualcomm)

Center of BWanother relative to edge of BWwanted is assumed to be at least 80MHz+BWanother/2 away from the edge of the wanted CC.

* + Option 2-1: (ZTE)

Not to consider additional minimum DL frequency separation in RAN4 specification for type 4a/4b UE. The minimum separation applicable to type2 in RAN4 specification also applies to type4a/4b.

* + Option 2-2: (Huawei)

For a type 4 UE, no minimum or maximum DL separation is needed to be specified in RAN4, as it was the case for type 2 UEs.

* + Option 3: (OPPO)

The min DL separation is proposed as Max (5/2\* BWanother, [50] MHz). There is no need to further capture this in the specification.

* Recommended WF
	+ Above options from companies seem to be not contradictory, so can be merged as follows.
	+ Agree with both proposals.

Proposal 1: Assume that Center of BWanother relative to edge of BWwanted is at least 80MHz+BWanother/2 away from the edge of the wanted CC.

Proposal 2: For Type 4 UE, no minimum DL separation is needed to be specified in RAN4, as it was the case for Type 2 UE.

Samusung: agree with proposal 1. For proposal 2, we can say ” not reflected by RAN4”

Huawei: we do not want to specify in RAN4. On LS, principly it is like Apple previous LS to RAN5. We can reply on previous LS from Apple in Rel-18. We do not block sending LS again for type 4.

Apple: Rel-18 LS clearly mentions type 2 UE. Another LS for type 4 UE is needed.

Agreement:

* Assume that Center of BWanother relative to edge of BWwanted is at least 80MHz+BWanother/2 away from the edge of the wanted CC.
* For Type 4 UE, minimum DL separation is not reflected in RAN4.

## Sub-topic 2-3 : UE Capability/UE behavior and network signaling for Type 4 EN-DC/NR-CA

### Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc#** | **Company** | **Proposals / Observations** |
| R4-2411290 | KDDI | ***Observation 1:*** Rel-18 BS signaling *nonCollocatedTypeNR-CA* and *nonCollocatedTypeMRDC* to switch between Type 1 and Type 2 is specified for the case with *maxMIMO-layers* less than or equal to 2.***Observation 2:*** In Rel-18, the case of *maxMIMO-layers* larger than 2 is collocated Type1.***Proposal 1:*** Specify capabilities both Type 4a for EN-DC and Type 4b for EN-DC and NR-CA.***Proposal 2:*** Specify Rel-19 BS signaling to switch between Type 1 and Type 4a/4b for the case with *maxMIMO-layers* larger than 2 and less than or equal to 4. Additionally, the case of *maxMIMO-layers* larger than 4 is collocated Type 1.

|  |  |
| --- | --- |
| **UE behavior/transitionFrom→To** | **To** |
| ①Type 4\_Non-colloc\_2cc\_4L/cc | ②Type 2\_Non-colloc\_2cc\_2L/cc | ③Type 1\_Colloc\_2cc\_4L/cc | ④Type 1\_Colloc\_2cc\_2L/cc | ⑤Single 1cc\_4L/cc |
| **From** | ①Type 4\_Non-colloc\_2cc\_4L/cc | N/A | *maxNumberMIMO-Layers*=4→2 | Rel-19 new BS signaling=1 | Rel-19 new BS signaling=1+*maxNumberMIMO-Layers*=4→2 | RRC Release Scell |
| ②Type 2\_Non-colloc\_2cc\_2L/cc | *maxNumberMIMO-Layers*=2→4 | N/A | Rel-18 *NonCollocatedTypeNR-CA*+*maxNumberMIMO-Layers*=2→4 | Rel-18 *NonCollocatedTypeNR-CA* | RRC Release Scell+*maxNumberMIMO-Layers*=2→4 |
| ③Type 1\_Colloc\_2cc\_4L/cc | Rel-19 new BS signaling=0 | Rel-18 *NonCollocatedTypeNR-CA*+*maxNumberMIMO-Layers*=4→2 | N/A | *maxNumberMIMO-Layers*=4→2 | RRC Release Scell |
| ④Type 1\_Colloc\_2cc\_2L/cc | Rel-19 new BS signaling=0+*maxNumberMIMO-Layers*=2→4 | Rel-18 *NonCollocatedTypeNR-CA* | *maxNumberMIMO-Layers*=2→4 | N/A | RRC Release Scell+*maxNumberMIMO-Layers*=2→4 |
| ⑤Single 1cc\_4L/cc | RRC Add Scell=0+Rel-19 new BS signaling | RRC Add Scell+Rel-18 *NonCollocatedTypeNR-CA*+*maxNumberMIMO-Layers*=4→2 | RRC Add Scell | RRC Add Scell+*maxNumberMIMO-Layers*=4→2 | N/A |

***Proposal 3:*** Not specify new BS signaling to switch between Type 2 and Type 4a/4b.***Proposal 4:*** Not specify new BS signaling to switch between single CC and Type 4a/4b.***Proposal 5***: Confirm the following understanding on *maxMIMO-layers* and Rel-18/19 BS signaling:* The case of *maxMIMO-layers* larger than 4 is Type 1.
* The case of *maxMIMO-layers* equal to 4 and
	+ Rel-19 New BS signaling is present with value 0 is Type 4.
	+ Rel-19 New BS signaling is present with value 1 is Type 1.
	+ Rel-19 New BS signaling is absent is that UE follows Rel-18 specification.
* The case of *maxMIMO-layers* equal to 2 and
	+ Rel-18 *nonCollocatedTypeNR-CA/nonCollocatedTypeMRDC* is present is Type 1.
	+ Rel-18 *nonCollocatedTypeNR-CA/nonCollocatedTypeMRDC* is absent is Type 2.
 |
| R4-2411312 | Samsung | ***Observation 1:*** For the per-BC UE capability design, to our understanding there are two alternatives from RAN2 perspective:* Alt 1) One UE capability (One IE name) for EN-DC and NR-CA, contained in both NR-CA container and EN-DC container. Which means although we use one capability, it can be used to indicate capability for EN-DC capability container and NR-CA capability container separately.
* Alt 2) Two UE capabilities, one dedicated for EN-DC and the other for NR-CA.

***Proposal 1:*** RAN4 to decide between following options, and deliver the agreements/demand to RAN2. While 1 UE capability or 2 UE capabilities can be left for RAN2 to determine and design.* Option 1:
	+ UE can support either Type-4a or Type-4b for EN-DC
	+ UE can support Type-4b for NR-CA → Samsung preference
* Option 2:
	+ UE can support Type-4 (i.e., Type-4b) for EN-DC
	+ UE can support Type-4 (i.e., Type-4b) for NR-CA

***Observation 2:*** To keep backward compatibility (i.e., for legacy gNB), UE still needs to report Type-2 UE capability if UE supports it.***Proposal 2:*** Modify last meeting’s agreements as following.***Proposal 3:*** It is proposed to confirm the possibility for the “switching paths” in above figure. Further, it is proposed to confirm that all paths are under NW full control. In addition.* No new NW signaling needed from Type-4 to Type-2 switch
* No new NW signaling needed from Type-4 to single carrier fallback
* New NW signaling needed from Type-4 to Type-1 (more details of New NW signaling is present in Proposal 4)

***Observation 3:*** In Rel-18, the Rel-18 NW signaling design is not like “If absent is non-collocated, if present is collocated ”, but rather the NW signaling is only present for a UE configured with *maxMIMO-layers* ≤2. And if *maxMIMO-layers*＞2, it is collocated.***Proposal 4:*** New Rel-19 NW signaling is needed to differentiate Type-4 and Type-1 when 2＜*maxMIMO-layers* ≤4.***Proposal 5:*** Confirm the following understanding for the usage of *maxMIMO-layers* and the new Rel-19 NW signaling and Rel-18 NW signaling:For the initial connection, if1）*maxMIMO-layers*≥8, it is collocated2）*maxMIMO-layers*=4, if Rel-19 new BS signaling IE is present, it could be either collocated(Type-1) or non-collocated(Type-4) pending on value is 0 or 1; If Rel-19 new BS signaling IE is absent, UE follows Rel-18 specification.3）*maxMIMO-layers*=2, it could be either collocated(Type-1) or non-collocated(Type-2), pending on whether existing NW signaling (*nonCollocatedTypeNR-CA* or *nonCollocatedTypeMRDC*) is present- Note: “If Rel-19 BS signaling IE is absent” intends for legacy NW or Rel-19 NW without Type-4 feature, “If Rel-19 BS signaling IE is present” intends for Rel-19 NW with Type-4 feature.  |
| R4-2411415 | Apple | ***Proposal 1:*** It is proposed to introduce two new UE capabilities with 1bit to indicate the most critical character for EN-DC Type 4 UE and CA Type 4 UE respectively. Where, for both EN-DC and CA,* When the bit is present, the UE is capable of handling up to 25dB power imbalance between carriers and up to 33us MRTD between carriers.
* When the bit is absent, the UE is capable of handling up to 6 dB power imbalance between CCs and up to 3us MRTD between carriers.

***Proposal 2:*** The overall capability for Type 4 UE is indicated by the new UE capability in proposal 1+inidication of maximum number of MIMO layers per CC by *maxNumberMIMO-LayersPDSCH*.***Proposal 3:*** No further distinction between Type 4a and 4b is needed for EN-DC type 4 UE from new UE capability perspective, i.e. Option 2.***Observation 1:*** Rel-18 BS signalling *nonCollocatedTypeNR-CA* and *nonCollocatedTypeMRDC* to switch between Type 1 and Type 2 is only specified for the case with *maxMIMO-layers* less than or equal to 2. It is by default 4Rx type 1 in collocated scenario when *maxMIMO-layers* equal to 4.***Proposal 4:*** To support type 4 UE switching between type 1 capability and type 4 capability, consider the following proposals.* When *maxMIMO-layers* equals 6 or 8, it is 6/8Rx type 1 in collocated scenario
* When *maxMIMO-layers* is less than or equal to 4, a clear network indication is needed to instruct UE to switch its RF chain between collocated scenario and non-collocated scenario.
	+ Note: signaling details could be left for RAN2 decision. E.g. either change the existing signaling description to accommodate type 4 UE or introduce new signaling for type 4 UE.

***Proposal 5:*** Confirm that if UE reports Type 4 capability, Type 2 capability shall be deemed as support by default regardless of whether UE indicates Type-2 capability or not. It is not necessary for UE to report Type 2 capabilities.***Proposal 6:*** no network indication is needed for type 4 UE to switch between type 2 capability and type 4 capability.***Proposal 7:*** it is proposed that RAN4 confirm the UE behaviour for type 4 UE as illustrated in figure 2.4-1.***Proposal 8:*** it is proposed to introduce RTD reporting to assist network scheduling type 4 UE with type 1 capability in non-collocated deployment.***Proposal 9:*** RAN4 further investigate additional condition in terms of in-GAP blocker for type 2/4 UE reconfiguration as type 1 capability.***Proposal 10:*** LS to RAN2 shall not be sent until all issues are settled in RAN4. |
| R4-2411893 | ZTE Corporation, Sanechips | ***Observation 1.*** BS signaling for nonCollocated ENDC and nonCollocated NRCA only present when a UE is configured with *maxMIMO-Layers* less than or equal to 2.***Observation 2.*** It is not expected that a UE reports both type 2 capability and type 4a/4b capability. ***Proposal 1.*** To consider separate capability reporting siganling for type 4a and type 4b respectively.***Proposal 2.*** BS signaling is needed for type switching between type 4a/4b and type 1.***Proposal 3.*** Not to introduce type switching between type 4a/4b and type 2 if no benefit can be expected. |
| R4-2412013 | Nokia, NSB | ***Proposal*:** it is enough UE to just indicate support for Type 4 as number of LTE receivers is indicated with *fourLayer-TM3-TM4* signalling. |
| R4-2412439 | Huawei, HiSilicon | ***Proposal 1*:** Introduce a single type 4 UE capability [*interBandMRDC-WithOverlapDL-Bands-r19*] and use the legacy UE capabilities to distinguish between Type 4a and 4b in EN-DC configuration. No need to introduce two separate UE capabilities for Type 4a and type 4b.**FeatureSetsEUTRA-r15> FeatureSetDL-PerCC-r15 > supportedMIMO-CapabilityDL-MRDC-r15 > MIMO-CapabilityDL-r10 ::= ENUMERATED {twoLayers, fourLayers, eightLayers}*****Proposal 2:*** Introduce a single Type 4 UE capability for NR-CA***Proposal 3:*** No need to have a special signalling to switch between type 4a and type 4b, as the NW can change the number of layers/CC using its legacy signallings easily.***Proposal 4:***A type 4 UE should report type 2 capabilities to be able to operate on legacy networks. An update on the agreement 2.2.2 of the WF R4-2410686 is necessary.***Proposal 5:*** Either the descriptions of *intraBandNR-CA-non-collocated-r18* and *interBandMRDC-WithOverlapDL-Bands-r16* in TS 38.306 need to be updated to link them to type 2 UEs, directly, or type 4 UE requirements should be on different sections than type 2 in TS 38.101-1 and TS 38.133 ***Proposal 6:*** No new NW IE is needed to perform type 4 to type 2 switching. Set *maxMIMO-Layers* =2 to change from type 4 to type 2. Consequently to switch from type 2 to type 4, set *maxMIMO-Layers* =4***Observation 1:*** As type 4 is capable of performing in collocated scenarios, there is no need to switch from type 4 to type 1 4Rx.***Proposal 7:*** Type 4 is the default type. To allow a switching from type 4a/b to type 1 with 6Rx/8Rx, RAN2 should, either introduce a new NW IE or extend *nonCollocatedTypeNR*-*CA*/ *nonCollocatedTypeMRDC* to make it applicable for UEs configured with *maxMIMO-Layers* ≤ 4, too. |
| R4-2412612 | Qualcomm | ***Observation 1****:* If there is only a single UE capability for Type4, then implementations supporting up to 6Rx for n42/n77/n78 cannot support this feature.***Proposal 2****:* Specify separate UE capabilities for Type 4a and Type 4b.***Observation 2****:* Rel-19 NW signaling to switch between Type 4 and Type 1 could be needed to ensure good UE functionality, pending further discussions. ***Observation 3****:* Potential discrepancy at between R19 UE and R18 NW must be addressed if new R19 signaling is defined.***Proposal 3:***Unless the previous assumption of Type 4 UE supporting Type 2 is reverted, there is no need for signaling. ***Proposal 4****:* RAN4 should first see if Type 3a/3b is included later into the WID scope, and after that send all UE capability and NW signaling decisions related into this WDI into RAN2 on one go.***Proposal 5****:* UE supporting Type 4a/4b could optionally support 6L/8L per CC in collocated mode (Type 1). |
| R4-2412729 | OPPO | ***Observation 1:*** The type 2 capability *intraBandNR-CA-non-collocated-r18* is defined as a per BC reported signalling and it is reported in *CA-ParametersNR*.***Observation 2:*** TS 38.101-1 only define the UE behaviour with *max-MIMO-layer* equals to 2 and assuming the largest *MIMO-layer* per Band is 4.***Observation 3:*** To report the type 4a/4b capability separately does not increase the signalling bits.***Proposal 1:***To add one new UE capability signalling with one bit to report the type 4a/4b capability.***Proposal 2:*** To define the NW signalling to differentiate type 4a/4b to configure UE working in proper status.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **intraBandNR-CA-non-collocated-type4** | **intraBandNR-CA-non-collocated-r18** | **UE type can be configured** | **nonCollocatedTypeNR-CA-type4** | **nonCollocatedTypeNR-CA-r18** | **Requirement apply** |
| a | Supported | 1，2，4 | a | Not provided | Type 4a |
| a | true | Type 4a |
| Not provided | Not provided | Type 2 |
| Not provided | true | Type 1 |
| a | Not reported | 1，4 | a | Network should not use this filed | Type 4a |
| Not provided | Type 1 |
| B | Supported | 1，2，4 | b | Not provided | Type 4b |
| b | true | Type 4b |
| Not provided | Not provided | Type 2 |
| Not provided | true | Type 1 |
| b | Not reported | 1，4 | b | Network should not use this filed | Type 4b |
| Not provided | Type 1 |
| Not reported | Supported | 1,2 | Network should not use this filed | true | Type 2 |
| Not provided | Type 1 |
| Not reported | Not reported | 1 | Network should not use this filed | Type 1 |

***Proposal 3:*** To agree on table 1 of the relationship between type 2 and type 4a/4b UE capability and NW signalling with corresponding applied requirement set. |
| R4-2412848 | Ericsson | ***Observation 1:*** All type 4a properties, #CC, antennas/LNA, mixer, BB, #RX, NRCA/EBDC-feature support and power imbalance, are a subset of type 4b. Moreover the difference between the type 4a and 4b are small. ***Proposal 1:*** We support option 2: add one new UE capability for Type 4 (no distinction between Type 4a and 4b) support indication. ***Observation 2:*** Type 1, as defined in rel-18 is not the same UE architecture as Type 1 in rel-19. Both are co-located, but the maximum number of supported layers and therefore number of RX differ from 4 to 8.***Observation 3:*** We are ok, in principle to define Type 1 ⟵Type 4, if we can agreewhat Type 1 means.***Proposal 2:*** Make Rel-18 Type 1 and Type 2 transition and Rel-19 Type 1 and Type 2 transition the same signal. ***Proposal 3:*** Do not define new signalling to switch between Type 4 and Type 2, instead rely on Type 4 MIMO rank reconfiguration. |

### Open issues summary

*Sub-topic description:*

R4-2411290(KDDI), R4-2411312(Samsung), R4-2411893(ZTE), R4-2412612(Qualcomm) and R4-2412729(OPPO) propose to separate UE capabilities for Type 4a and 4b support indication.

On the other hand, R4-2411415(Apple), R4-2412013(Nokia), R4-2412439(Huawei) and R4-2412848(Ericsson) proposes to add only one new UE capability for Type 4 support indication.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-1: New UE Capability for Type 4a(6Rx/UE) and 4b(8Rx/UE) for EN-DC/NR-CA**

* Proposals
	+ Option 1: (KDDI/Samsung/Qualcomm/OPPO)
* UE can support either Type 4a or Type 4b for EN-DC
* UE can support Type 4b for NR-CA
	+ Option 2-1: (Apple/Ericsson)
* UE can support Type 4 (i.e., Type 4b, no distinction between Type 4a and 4b) for EN-DC
* UE can support Type 4 (i.e., Type-4b) for NR-CA
	+ Option 2-2: (Huawei/Nokia)
* 1 UE capability for Type 4
	+ The distinction between 4a and 4b is possible via legacy capabilities.
* UE can support Type 4 (i.e., Type-4b) for NR-CA
* Recommended WF
	+ Firstly, decide one direction on how to declare UE Capabilities by UE between above options, and deliver the agreements/demand to RAN2.
	+ Specific UE Capabilities’ design depends on RAN2.

Nokia: Our proposal is the same as Ericsson.

Apple: Regarding 2-2, what is the signaling differentating 4a and 4b?

Huawei: Type 4b and Type 4a, depending on layer number, network can know whether it is 4a and 4b by using the legacy signaling.

Nokia: it is related to LTE carriers.

Ericsson: 2-2 is fine for Ericsson. One type 4 capability is preferrable to simplify signaling design. We can flip for some configuration.

OPPO: There may be some misundersanding. Type 4a and 4b are for both LTE and NR. It is not suitable for NR DC case. We want to decouple it for the signaling. That is why for option 1.

Apple: 2-1 and 2-2 are the same. These can be differentiated by mimo layer.

Moderator: For 2-2 the legacy signalling is used, which is not correct.

Nokia: there is legacy LTE signalling. The existing signalling is enough.

Samsung: There are multiple feasible solutions. Among them we should choose most clean one. We need follow Rel-16 to have two signaling, one for CA and one for DC.

Huawei: to OPPO, we do not have type 4a and 4b for NR CA. We just have it for NR DC. That is why we are talking about LTE signalling. For BS signalling, we show the MIMO capability which enable us to make such switching possible to inform gNB whether it is type 4a or 4b. To Samsung, with one UE capability, it is already clean.

OPPO: To Huawei, for NR band, 4Rx is mandated. 4a and 4b, 6Rx is used. Although we try to differentiate 4a or 4b, this is still one bit capability.

Nokia: why 4a is not applied to NR CA? 4-layer is mandated. So 4a is not allowed.

Qualcomm: do you see possible to deploy 6Rx? If 8Rx is the only case...

Tentative agreement:

* Define one capability for NR CA and one capability for EN-DC
	+ FFS on how to differentiate type 4a and 4b.

*Sub-topic description:*

R4-2411312(Samsung) and R4-2412439(Huawei) propose to modify last meeting’s agreements for backward compatibility, because legacy BS can’t understand Type 4 capability.

On the other hand, R4-2411415(Apple) propose to keep last meeting’s agreements.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-2: Whether to support Type 2 capability by UE having Type 4 capabilities**

* Proposals
	+ Option 1: (Samsung/Huawei)

Modify last meeting’s agreements as following with yellow highlighted part.

|  |
| --- |
| RAN4#111 < Issue 2-2-2: Whether to support Type 2 capability by UE having Type 4 capabilities >**Agreement:*** If UE reports the Type 4 capability, Type 2 capability shall be deemed as support by default. UE still needs to report Type 2 Capability if UE supports it in order to keep backward compatibility (i.e., for legacy BS). ~~regardless of whether UE indicates Type-2 capability or not.~~
	+ ~~If UE reports the Type 4 capability, it is not necessary for UE to report Type 2 capabilities.~~
	+ ~~If the issue is identified for these bullets, RAN4 will revisit them.~~
 |

* + Option 2: (Apple)

Keep last meeting’s agreements.

* Recommended WF
	+ Collect companies’ views.

Apple: for type 4 UE, the fallback should be type 2. Type 2 will be supported by defaul if UE reports type 4.

Mediatek: We think the proposal is fine for us. I am not the fallback argument.

KDDI: we support option 1. We should avoid the NBC issue.

Samsung: to Apple, if UE only reports Type 4 and type 2, the legacy network cannot understand UE is type 2 UE.

Apple: This UE should be type 2 first. If network does not understand, UE cannot access network.

Huawei: we have legacy network in Rel-18. There is no type 4 UE capability reporting. UE needs type 2 signaling for legacy network for non-collocated scneario for FWA UE.

Nokia: Same comments as Samsung and Huawei.

*Sub-topic description:*

R4-2411290(KDDI), R4-2411312(Samsung), R4-2411415(Apple), R4-2412439(Huawei), R4-2412729(OPPO) and R4-2412848(Ericsson) proposes not to add new BS signalling to switch between Type 4 capability or Type 2 capability.

On the other hand, R4-2412612(Qualcomm) propose unless the previous assumption of Type 4 UE supporting Type 2 is reverted, there is no need for signaling.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-3: New BS Signaling to switch between Type 4a/4b and Type 2**

* Proposals:
	+ Option 1: (KDDI/Samsung/Apple/Huawei/OPPO/Ericsson)

No new NW signaling needed from Type-4 to Type-2 switch and maxMIMO-layer can be used.

* + Option 2: (Qualcomm)

Unless the previous assumption of Type 4 UE supporting Type 2 is reverted, there is no need for signaling.

* Recommended WF
	+ Check Qualcomm’s intention. If there is no difference between Option 1 and 2, agree with Option 1.

Agreement: No new NW signaling needed from Type-4 to Type-2 switch and maxMIMO-layer can be used.

*Sub-topic description:*

R4-2411312(Samsung), R4-2411415(Apple), R4-2411893(ZTE) and R4-2411290(KDDI) propose to add new BS signalling to switch between Type 4 capability or Type 1 capability. And then, R4-2412729(OPPO) proposes to define BS signalling to differentiate Type 4a/4b to configure UE working in proper status.

On the other hand, R4-2412439(Huawei) says that as Type 4 is capable of performing in collocated scenarios, there is no need to switch from Type 4 to Type 1 4Rx.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-4: New BS Signaling to switch between Type 4a/4b and Type 1 4L/CC(collocated)**

* Proposals
	+ Option 1-1: (KDDI)

Specify Rel-19 BS signaling to switch between Type 1 and Type 4a/4b for the case with *maxMIMO-layers* larger than 2 and less than or equal to 4.

* + Option 1-2: (Samsung)

New Rel-19 NW signaling is needed to differentiate Type 4 and Type 1 when 2<*maxMIMO-layers* ≤4.

* + Option 1-3: (Apple)

When *maxMIMO-layers* is less than or equal to 4, a clear network indication is needed to instruct UE to switch its RF chain between collocated scenario and non-collocated scenario.

o Note: signaling details could be left for RAN2 decision. E.g. either change the existing signaling description to accommodate Type 4 UE or introduce new signaling for Type 4 UE.

* + Option 1-4: (ZTE)

BS signaling is needed for Type switching between type 4a/4b and Type 1.

* + Option 1-5: (OPPO)

Define the NW signalling to differentiate Type 4a/4b to configure UE working in proper status.

* + Option 2: (Huawei)

There is no need to switch from Type 4 to Type 1 4Rx

* Recommended WF
	+ Firstly, discuss to merge 5 options (from 1-1 to 1-5) to the following one Option 1.
	+ Option 1:

New BS signaling is needed to differentiate Type 4 and Type 1 when *maxMIMO-layers*=4.

* + Next, discuss Option 1 and Option 2.

Huawei: what are the switching for? Why do we need to switch from 4Rx to 4Rx.

OPPO: Share the similar view as Huawei. We use option 5 to discuss the switching between 4a and 4b rather than between 4 and 1.

Nokia: We think switching between type 4 and 1 is needed.

Samsung: we agree with Nokia. The switching between 4 and 1 is needed. To Ericsson, in Rel-19 we have different type 1 with 4-layer per CC, type 1 with 6-layer per CC... We can assume 4-layer per CC is baseline, which does not mean UE will end up with 4-layer per CC.

Huawei: We agree with one type 1 can move downlink MIMO layers. But we do not need to move to 4Rx. The baseline should not be 4-layer and then switch to 6Rx or 8Rx.

Nokia: about the power imbalance capability.

*Sub-topic description:*

R4-2411312(Samsung), R4-2411415(Apple), and R4-2411290(KDDI) propose to use *maxMIMO-Layers* to switch between Type 4a/4b and Type 1 8L/CC.

On the other hand, R4-2412439(Huawei) proposes to allow a switching from type 4a/b to type 1 with 6Rx/8Rx. RAN2 should, either introduce a new NW IE or extend *nonCollocatedTypeNR-CA/nonCollocatedTypeMRDC* to make it applicable for UEs configured with *maxMIMO-Layers ≤ 4*, too..

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-5: New BS Signaling to switch between Type 4a/4b and Type 1 6L/8L/CC(collocated)**

* Proposals
	+ Option 1-1: (Samsung)

*maxMIMO-layers≥8,* it is collocated

* + Option 1-2: (KDDI)

The case of *maxMIMO-layers* larger than 4 is collocated Type 1.

* + Option 1-3: (Apple)

When *maxMIMO-layers* equals 6 or 8, it is 6/8Rx Type 1 in collocated scenario

* + Option 2: (Huawei)

To allow a switching from Type 4a/b to Type 1 with 6Rx/8Rx, RAN2 should, either introduce a new NW IE or extend *nonCollocatedTypeNR-CA/nonCollocatedTypeMRDC* to make it applicable for UEs configured with *maxMIMO-Layers* ≤ 4, too.

* Recommended WF
	+ Firstly, discuss to merge 3 options (from 1-1 to 1-3) to the following one option.
	+ Option 1:

When *maxMIMO-layers* = 6 or 8, it is 6/8Rx Type 1 in collocated scenario

* + Next, discuss Option 1 and Option 2.

*Sub-topic description:*

R4-2411312(Samsung), and R4-2411290(KDDI) propose that no new NW signaling needed from Type 4 to single carrier operation.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-6: Switch between Type 4a/4b and single CC operation**

* Proposals
	+ Option 1-1: (Samsung)

No new NW signaling needed from Type-4 to single carrier fallback.

* + Option 1-2: (KDDI)

Not specify new BS signaling to switch between single CC and Type 4a/4b.

* Recommended WF
	+ Agree with that no new NW signaling needed from Type-4 to single carrier fallback.

*Sub-topic description:*

R4-2411312(Samsung), and R4-2411290(KDDI) propose UE behaviors during initial connection between Type 1, Type 2 and Type 4a/4b. While during the offline discussion among companies before submission deadline, there are two good counter-examples provided by MediaTek, which demonstrates the Rel-18 based BS signaling design like a simple “present-absent” way is not good enough. Specifically, if Rel-19 BS signaling is designed like a simple “present-absent” way same as Rel-18, we would face the following issues and the Rel-18 argument would repeat.

1. Rel-19 Type 4 capable UE behavior operate under Rel-18 BS.

Assuming a Rel-19 UE indicates both Type 4 and Type 2 capability, then Rel-18 BS only understand Type 2 and use *maxMIMO-layers*=4 to control UE work under collocatedif following above design, but Rel-19 UE would see "new Rel-19 BS signaling =absent + *maxMIMO-layers*=*4*", then this UE misthink Non-collocated Type 4. Discrepancy between UE and BS happens. (Note in our understanding, UE has no idea of BS is of which release, and also BS has no idea of the UE is of which release.)

1. Only Type 2 capable Rel-19 UE behavior under Rel-19 BS.

Seems we can just follow Rel-18 design in this case? If Type 4 is not reported, it implies this UE does not understand new Rel-19 BS signaling. So, for collocated, Rel-19 BS just use " *maxMIMO-layers*=4". If this is common understanding, seems there would be no issue. But this needs to be clarified.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-7: UE behavior during initial connection between Type 1, Type 2 and Type 4a/4b**

* Proposals
	+ Option 1: (KDDI)

Confirm the following understanding on *maxMIMO-layers* and Rel-18/19 BS signaling:

* The case of *maxMIMO-layers* larger than 4 is Type 1.
* The case of *maxMIMO-layers* equal to 4 and
	+ Rel-19 New BS signaling is present with value 0 is Type 4.
	+ Rel-19 New BS signaling is present with value 1 is Type 1.
	+ Rel-19 New BS signaling is absent is that UE follows Rel-18 specification.
* The case of *maxMIMO-layers* equal to 2 and
	+ Rel-18 *nonCollocatedTypeNR-CA/nonCollocatedTypeMRDC* is present is Type 1.
	+ Rel-18 *nonCollocatedTypeNR-CA/nonCollocatedTypeMRDC* is absent is Type 2.
	+ Option 2: (Samsung)

Confirm the following understanding for the usage of maxMIMO-layers and the new Rel-19 NW signaling and Rel-18 NW signaling:

For the initial connection, if

1）*maxMIMO-layers*≥8, it is collocated

2）*maxMIMO-layers*=4, if Rel-19 new BS signaling IE is present, it could be either collocated(Type-1) or non-collocated(Type-4) pending on value is 0 or 1; If Rel-19 new BS signaling IE is absent, UE follows Rel-18 specification.

3）*maxMIMO-layers*=2, it could be either collocated(Type-1) or non-collocated(Type-2), pending on whether existing NW signaling (*nonCollocatedTypeNR-CA* or *nonCollocatedTypeMRDC*) is present

- Note: “If Rel-19 BS signaling IE is absent” intends for legacy NW or Rel-19 NW without Type-4 feature, “If Rel-19 BS signaling IE is present” intends for Rel-19 NW with Type-4 feature.

* Recommended WF
	+ Collect companies’ views.

*Sub-topic description:*

R4-2411415(Apple) proposes to introduce RTD reporting to assist network scheduling type 4 UE. In Rel-18, RAN4 discussed it and agreed not to introduce it.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-8: Introduce RTD reporting to assist network scheduling Type 4 UE**

* Proposal: (Apple)
	+ Introduce RTD reporting to assist network scheduling type 4 UE with type 1 capability in non-collocated deployment.
* Recommended WF
	+ Collect companies’ views.

*Sub-topic description:*

R4-2411415(Apple) proposes that LS to RAN2 shall not be sent until all issues are settled in RAN4. R4-2412612(Qualcomm) proposes to first see if Type 3a/3b is included later into the WID scope, and after that send all UE capability and BS signaling decisions related into this WID into RAN2 on one go.

*Open issues and candidate options before e-meeting:*

#### **Issue 2-3-9: When to inform RAN2 the demand on new UE capability(s) and new BS signaling**

* Proposals
	+ Option 1: (Apple)

LS to RAN2 shall not be sent until all issues are settled in RAN4

* + Option 2: (Qualcomm)

RAN4 should first see if Type 3a/3b is included later into the WID scope, and after that send all UE capability and NW signaling decisions related into this WDI into RAN2 on one go.

* Recommended WF
	+ Collect companies’ views.

####  **Issue 2-3-10: In-GAP interference impact on Type 4 UE reconfiguration**

*Sub-topic description:*

R4-2411415(Apple) propose to discuss and confirm whether and how to factor in the in-GAP interference impact on Type 4 UE reconfiguration. This issue is same as Issue 1-1-1 for Rel-18 Type 2, and it also seems to be discussed in Rel-19 Fragmented Carrier WI in parallel.

*Open issues and candidate options before e-meeting:*

* Proposals
	+ Option 1: (Apple)

RAN4 further investigate additional condition in terms of in-GAP blocker for Type 2/4 UE reconfiguration as Type 1 capability.

* + Option 2: (Moderator)

To avoid duplicated discussion, RAN4 discuss and confirm whether and how to factor in the in-GAP interference impact on Type 2 UE reconfiguration in [112][125] FS\_NR\_DL\_Frag\_Carrier.

* Recommended WF
	+ Firstly, discuss Issue 1-1-1. And then, this issue depends on a result of Issue 1-1-1.

## Sub-topic 2-4 : Other aspects (incl. clarification of contiguous LTE CCs)

### Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc#** | **Company** | **Proposals / Observations** |
| R4-2411289 | KDDI,LG Uplus, NTT DOCOMO INC., SoftBank | ***Observation 1:*** The working assumption of RP-240101 can be reused in RAN4.***Observation 2:*** WF R4-2406628 for Type 2 can be reused for Type 4a/4b.***Proposal 1:*** The number of CCs for Type 4a/4b.* Non-collocated EN-DC
* B42: multiple contiguous CCs, all collocated
	+ Based on the requested band combinations (see R4-2406628)
* n77/n78: one CC
* Non-collocated NR-CA
* n77/n78: Non-contiguous two CCs, non-collocated

***Proposal 2:*** If TU still remains in Rel-19, discuss other scenario(s) of the number of CCs and contiguous cases later. |
| R4-2411416 | Apple | ***Proposal 1:*** It is proposed that the maximum number of contiguous LTE CCs is 4 (bandwidth class E) for inter-band EN-DC with overlapping DL frequency. ***Proposal 2:*** It is proposed to confirm whether there are cases where different co-existence requirements need to be implemented due to incumbent service in part of a spectrum block.***Proposal 3:*** It is proposed to consider bandwidth class C for NR CA or NR mode of EN-DC if the answer to proposal 2 is yes. Otherwise, one NR CC should be sufficient. ***Observation:*** For NR CA, the combination of contiguous CA and non-contiguous CA is still missing for Band n77 and n78. |
| R4-2412728 | OPPO | ***Proposal 1:*** For EN-DC of type 4 UE, number of LTE CCs can be up to 4 and only co-located contiguous LTE CCs is considered.***Proposal 2:*** For NR CA of type 4 UE, number of NR CCs can be up to 3 and only co-located contiguous NR CCs is considered. |

### Open issues summary

*Sub-topic description:*

R4-2411289(KDDI/LG Uplus/Docomo/SoftBank) propose based on the requested band combinations to align to the agreed WF R4-2406628 on the number of B42 CCs for EN-DC.

On the other hand, R4-2411416(Apple) and R4-2412728(OPPO) propose up to four.

*Open issues and candidate options before e-meeting:*

**Issue 2-4-1: The number of B42 CCs for Type 4 EN-DC**

* Proposals
	+ Option 1: (KDDI/LG Uplus/Docomo/SoftBank)

B42: multiple contiguous CCs, all collocated

* + - * Based on the requested band combinations (see R4-2406628)
	+ Option 2: (Apple/OPPO)

Up to four, contiguous and all collocated.

* Recommended WF
	+ Collect companies’ views.

Apple: both option 1 and 2 metions the current number of CCs as 4. They are aligned.

Agreement:

* B42: multiple contiguous CCs, all collocated
	+ Based on the requested band combinations (see R4-2406628)

*Sub-topic description:*

R4-2411289(KDDI/LG Uplus/Docomo/SoftBank) propose one CC of n77/n78 for Non-collocated EN-DC and Non-contiguous two CCs, non-collocated of n77/n78 for Non-collocated NR-CA, and also if TU is still remained in Rel-19, discuss other scenario(s) of the number of CCs and contiguous cases later. This is operators’ demand.

On the other hand, R4-2412728(OPPO) propose up to 3 and only co-located contiguous

*Open issues and candidate options before e-meeting:*

**Issue 2-4-2: The number of NR CCs for Type 4 EN-DC and NR-CA**

* Proposals
	+ Option 1: (KDDI/LG Uplus/Docomo/SoftBank)

Same as Type 2 as follows.

* Non-collocated EN-DC
	+ - * + n77/n78: one CC
* Non-collocated NR-CA
	+ - * + n77/n78: Non-contiguous two CCs, non-collocated

Additionally, if TU is still remained in Rel-19, discuss other scenario(s) of the number of CCs and contiguous cases later.

* + Option 2: (OPPO)

Up to 3 and only co-located contiguous

* Recommended WF
	+ Prioritize the following number of NR CCs same as Type 2.
* Non-collocated Type 4 EN-DC
	+ - * + n77/n78: one CC
* Non-collocated Type 4 NR-CA
	+ - * + n77/n78: Non-contiguous two CCs, non-collocated
	+ If TU is remained in Rel-19, discuss other scenario(s) of the number of CCs and contiguous cases later.

Agreement:

* + Prioritize the following number of NR CCs same as Type 2.
* Non-collocated Type 4 EN-DC
	+ - * + n77/n78: one CC
* Non-collocated Type 4 NR-CA
	+ - * + n77/n78: Non-contiguous two CCs, non-collocated
	+ If TU is remained in Rel-19, discuss other scenario(s) of the number of CCs and contiguous cases later.

## Sub-topic 2-5 : LS to RAN5

### Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc**  | **Company** | **Title/Comments** | **Recommendation** |
| R4-2411419 | Apple | LS on power imbalance testing for Type 4 UE *Moderator’s note:**To RAN5:**ACTION: RAN4 respectfully asks RAN5 to consider the agreed test condition in their future specification work.* | *Same as Rel-18, agree to send the LS to RAN5.* |

**Issue 2-5-1: LS to RAN5**

* Proposal (Apple)
	+ Send LS to RAN5 on power imbalance testing for Type 4 UE
* Recommended WF
	+ Collect companies’ views.

## CRs for 38.101-1

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc**  | **Company** | **Title/Comments** | **Recommendation** |
| R4-2411417Rel-19CAT-B: | Apple | Draft CR on RF requirement update for type 4 UE*Moderator’s note:* *This CR is a late contribution.* |  |

## CRs for 38.101-3

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc**  | **Company** | **Title/Comments** | **Recommendation** |
| R4-2411418Rel-19CAT-B: | Apple | Draft CR on RF requirement update for type 4 UE*Moderator’s note:* *This CR is a late contribution.* |  |