3GPP TSG-RAN WG4 Meeting #110bis R4-2405287

Changsha, China, April 15th – 19th, 2024

**Agenda item:** 9.10.3

**Source:** Moderator (Intel Corporation)

**Title:** Topic summary for [110bis][134] NR\_FR1\_5MHz\_BW\_Ph2

**Document for:** Information

# Introduction

A new Rel-19 WI on **NR channel BW less than 5MHz for FR1 evolution** (RP-240832) was approved in RAN#103 with the following objectives:

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| --- |
| 4 Objective4.1 Objective of SI or Core part WI or Testing part WI  * Define common co-located and non-co-located inter-band NR CA/DC UE RF requirements with 3MHz CBW in the one band and 5MHz or 10MHz CBW in the other band   + Example band combination: CA/DC of 3MHz in band n100 and 5MHz or 10MHz in band n101 * Define RRM requirements for inter-band CA and DC for combinations introduced in RF part   Note: other band combinations than example band combinations can be specified in basket WIs after the above generic requirements are specified. 4.2 Objective of Performance part WI NOTE: Leave empty if the WI proposal does not contain a RAN performance part.   * Specify necessary performance requirements (RAN4) |

This summary handles the tdoc submitted for AI 9.10 for the Rel-19 NR\_FR1\_5MHz\_BW\_Ph2 WI and addresses the following Topics:

* Topic #1: Work plan
* Topic #2: UE RF requirements for inter-band NR CA/DC with 3MHz CBW
* Topic #3: Regulations for multi-carrier operation in bands n100/n101

The following tdocs are handled in this summary document:

|  |  |  |  |
| --- | --- | --- | --- |
| **TDoc** | **Title** | **Source** | **Agenda item** |
| [**R4-2404735**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404735.zip) | Workplan for Rel-19 NR channel BW less than 5MHz for TN work item | Intel Corporation | 9.10.1 |
| [**R4-2405912**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405912.zip) | Analysis of the ECC regulation for multi-carrier operation in n100/n101 | Huawei, HiSilicon, Vodafone, Orange, Telia Company, Telefónica, Deutsche Telekom | 9.10.1 |
| [**R4-2405913**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405913.zip) | Draft CR to TS 38.104: Clarification on multiple carrier operation for n100/n101, Rel-17 | Huawei, HiSilicon | 9.10.1 |
| R4-2405914 | Draft CR to TS 38.104: Clarification on multiple carrier operation for n100/n101, Rel-18 | Huawei, HiSilicon | 9.10.1 |
| [**R4-2405915**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405915.zip) | Draft CR to TS 38.141-1: Clarification on multiple carrier operation for n100/n101, Rel-17 | Huawei, HiSilicon | 9.10.1 |
| R4-2405916 | Draft CR to TS 38.141-1: Clarification on multiple carrier operation for n100/n101, Rel-18 | Huawei, HiSilicon | 9.10.1 |
| [**R4-2404257**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404257.zip) | DC CA UE Requirements in the case of 3MHz CBW | Huawei Technologies France | 9.10.2 |
| [**R4-2404288**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404288.zip) | UE RF specification impact for inter-band NR CA/DC with 3MHz CBW | Nokia | 9.10.2 |
| [**R4-2404453**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404453.zip) | On UE RF requirements for inter-band NR CA/DC with 3MHz CBW | CATT | 9.10.2 |
| [**R4-2404500**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404500.zip) | draftCR for inter-band NR CA/DC with 3MHz CBW (System parameter part) | CATT | 9.10.2 |
| [**R4-2404736**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404736.zip) | Discussion on the RF spec scope of Rel-19 less than 5MHz work item for TN | Intel Corporation, UIC | 9.10.2 |
| [**R4-2404784**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404784.zip) | Discussion for UE RF requirements for inter-band NR CA/DC with 3MHz CBW | LG Electronics France | 9.10.2 |
| [**R4-2405062**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405062.zip) | Discussion on UE RF requirements inter-band NR CA/DC with 3MHz CBW | ZTE Corporation | 9.10.2 |
| [**R4-2405714**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405714.zip) | UE RF impacts from NR less than 5 MHz phase 2 | Qualcomm Inc. | 9.10.2 |
| [**R4-2405765**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405765.zip) | TP adding 3MHz example combination CA\_n100-n101 | Ericsson | 9.10.2 |
| [**R4-2405766**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405766.zip) | draft CR adding 3MHz example combination CA\_n100-n101 | Ericsson | 9.10.2 |

# Topic #1: Work plan

*Topic description:* ***Work plan for the WI RF and RRM Core part***

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2404735](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404735.zip) | Intel Corporation | Proposal 1: RAN4 to agree on the RF core parts of the workplan as presented in the above in this contribution.  Proposal 2: RAN4 continue discussion on RRM core parts in the August meeting. |

## Open issues summary

*Open issues and candidate options before meeting:*

### Issue 1-1: Work plan for RF Core part for NR\_FR1\_5MHz\_BW\_Ph2

* Proposals
  + Proposal 1: RAN4 to agree on the RF core parts of the workplan

|  |  |
| --- | --- |
| Meeting | RF |
| RAN4#110bis  Apr’24 | Discussions on   * Scope of RF requirements and spec impact for BS and UE * Workplan for RF requirements and RRM requirements   Agreements on   * Workplan on RF core requirements |
| RAN4#111  May’24 | Discussions on   * (continued) Scope of RF requirements and spec impact for BS and UE   Agreements on   * Scope of RF requirements and spec impact |
| RAN4#112  Aug’24 | Discussions on   * UE and BS (if any) RF requirements for inter-band CA and DC with 3MHz in band n100 and 5 or 10MHz in band n101 * General RF requirements for inter-band CA and DC with 3MHz in one of the bands and 5 or 10MHz in the other * Possible draftCR or CR contents   Agreements on   * UE and BS (if any) RF requirements for inter-band CA and DC with 3MHz in band n100 and 5 or 10MHz in band n101 |
| RAN4#112bis  Oct’24 | Discussions on   * (continued) UE and BS (if any) RF requirements for inter-band CA and DC with 3MHz in band n100 and 5 or 10MHz in band n101 * (continued) General RF requirements for inter-band CA and DC with 3MHz in one of the bands and 5 or 10MHz in the other * draftCR or CR contents   Agreements on   * UE and BS (if any) RF requirements for inter-band CA and DC with 3MHz in band n100 and 5 or 10MHz in band n101 * General RF requirements for inter-band CA and DC with 3MHz in one of the bands and 5 or 10MHz in the other * draftCR contents |
| RAN4#113  Nov’24 | Discussions on   * (continued) UE and BS (if any) RF requirements for inter-band CA and DC with 3MHz in band n100 and 5 or 10MHz in band n101 * (continued) General RF requirements for inter-band CA and DC with 3MHz in one of the bands and 5 or 10MHz in the other * (continued) CR contents   Agreements on   * UE and BS (if any) RF requirements for inter-band CA and DC with 3MHz in band n100 and 5 or 10MHz in band n101 * General RF requirements for inter-band CA and DC with 3MHz in one of the bands and 5 or 10MHz in the other * CR contents |

* Recommended WF
  + Collect inputs on the proposed Work Plan
  + Endorse the work plan.

### Issue 1-2: Work plan for RRM Core part for NR\_FR1\_5MHz\_BW\_Ph2

* Proposals
  + Proposal 1: RAN4 continue discussion on RRM core parts in the August meeting

|  |  |
| --- | --- |
| Meeting | RRM |
| RAN4#112  Aug’24 | Discussions on   * Scope of RRM requirements for PCell/SCell operating with 3MHz channel bandwidth   Agreements on   * Scope of RRM requirements |
| RAN4#112bis  Oct’24 | Discussions on   * RRM requirements for SCell operating with 3MHz channel bandwidth * Possible draftCR contents   Agreements on   * RRM requirements for SCell operating with 3MHz channel bandwidth * draftCR contents |
| RAN4#113  Nov’24 | Discussions on   * (continued) RRM requirements for SCell operating with 3MHz channel bandwidth * CR contents   Agreements on   * RRM requirements for SCell operating with 3MHz channel bandwidth * CR contents |

* Recommended WF
  + Handle the discussion in RAN4#112 in the RRM session.

# Topic #2: UE RF requirements for inter-band NR CA/DC with 3MHz CBW

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2404257**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404257.zip) | DC CA UE Requirements in the case of 3MHz CBW | Huawei | Observation 1: This WI could cover inter-band NR CA and EN DC (without overlapping DL frequencies) band combinations, with at least of the bands of n100, n106, n26, n28 or n85, for co-located and non-co-located deployments.  Observation 2: Among EN-DC band combinations with overlapping DL frequencies, only DC\_20A\_n28A, is included in this WI.  Observation 3: for this WI, on the band that supports 3MHz CBW, only 1 CC with a 3MHz CBW is supported.  Proposal 1 specify band combinations with 1 CC/ band.  Proposal 2: Based on the Table below (which is a summarized version of Table 2), the following requirements for Inter-band NR CA and Inter-band DC needs to be updated. |
| [**R4-2404288**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404288.zip) | UE RF specification impact for inter-band NR CA/DC with 3MHz CBW | Nokia | Proposal 1: To approve Table 1 for the required changes of the UE RF requirements in TS 38.101-1 to support inter-band NR CA/DC with 3MHz CBW in band n100 and 5MHz or 10MHz CBW in band n101. |
| [**R4-2404453**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404453.zip) | On UE RF requirements for inter-band NR CA/DC with 3MHz CBW | CATT | Proposal 1: Include both single UL and two simultaneous UL transmission in the UL configuration for the example band combination n100+n101.  Proposal 2: Exclude CA\_n100A-n101B from the WID, i.e., only CA\_n100A-n101A for two UL’s configuration.  Proposal 3: Endorse the draft CR on system parameter part for the inter-band combination CA\_n100A-n101A.  Proposal 4: Do not introduce an optional capability indicating the support of CA/DC a band combination with 3MHz channel bandwidth in one of the bands in the band combination. |
| [**R4-2404500**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404500.zip) | draftCR for inter-band NR CA/DC with 3MHz CBW (System parameter part) | CATT | Draft CR on introduction of CA\_n100A-n101A |
| [**R4-2404736**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404736.zip) | Discussion on the RF spec scope of Rel-19 less than 5MHz work item for TN | Intel, UIC | Proposal 1: Specify in the UE RF spec for CA\_n100-n101 with 3MHz in n100 and 5 or 10MHz in n101, the above listed requirements.  Proposal 2: Specify for DC\_n100-n101 the same requirements as for CA\_n100-n101.  Observation: After we finish the generic requirements definition and the example combo definitions, we will use the existing basket or start a basket work item under the guidance of RAN4 and RANP leadership and based on the consensus of companies. The basket work item accommodates new requests from interested parties and specifies the combo specific requirements. |
| [**R4-2404784**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2404784.zip) | Discussion for UE RF requirements for inter-band NR CA/DC with 3MHz CBW | LGE | Observation 1: PC3 and PC1 have been specified for band n100 and n101.  Proposal 1: It is necessary to discuss whether PC3 and PC1 can be defined for inter-band CA/DC with 3MHz CBW.  Proposal 2: The MPR requirements for single band can be reused for the MPR requirements for inter-band CA/DC with 3MHz.  Proposal 3: The MSD requirements for harmonic, harmonic mixing, intermodulation and cross band isolation should be defiend for inter-band CA/DC with 3MHz according to co-existence study.  Proposal 4: New MSD table for PC1 should be added to spec, if PC1 inter-band CA/DC with 3MHz CBW is specified.  Observation2: The maximum output power for PC1 is 31 dBm, which means that the MSD value for inter-band CA/DC with 3MHz CBW PC1 can be very large, and the DL coverage will be significantly shrunk. However, devices for PC1 are not targeted for the smartphone form factor as shown in Note 6 of Table 6.2.1-1 of TS38.101-1, which means that the relaxed assumption for MSD analysis such as high PCB&antenna isolation can be considered, and a reasonable MSD value can be derived.  Proposal 5: The relaxed assumption for MSD analysis is needed, if PC1 inter-band CA/DC with 3MHz CBW is specified. |
| [**R4-2405062**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405062.zip) | Discussion on UE RF requirements inter-band NR CA/DC with 3MHz CBW | ZTE | Proposal 1: To define the new inter-band CA operating band as in Table 2.1-1.  Proposal 2: To define the new NR CA configuration and bandwidth combination sets for inter-band CA as in Table 2.1-2.  Proposal 3: To define the new inter-band NR DC configuration for inter-band CA as in Table 2.1-3.  Proposal 4: For inter-band CA\_n100-n101, the possible RF architecture implementation can be assumed as is shown in Figure 2.2-1.  Proposal 5: Inter-band CA/DC of 3MHz in band n100 and 5MHz or 10MHz in band n101 should support PC 3 and UE maximum output power can be defined as Table 2.2-1 and 2.2-2.  Proposal 6: For inter-band CA\_n100-n101, no MSD issue needs to be discussed.  Observation 1: Whether a new signalling of indicating inter-band non-collocated is required needs discussion.  Proposal 7: Considering power imbalance parameters for non-co-located inter band CA\_n100-n101, 25 dB power imbalance can be reused. |
| [**R4-2405714**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405714.zip) | UE RF impacts from NR less than 5 MHz phase 2 | Qualcomm | Observation 1: Clarification is needed on whether UL CA is needed for the example band combination.  Observation 2: RAN4 should further discuss the applicability of the extraordinary 12 and 20 RB transmission bandwidth configurations for CA and required improvements in related signalling.  Proposal 1: RAN4 to further clarify the scope of work especially on whether UL CA is considered and whether 12 and 20 RB transmission bandwidth configurations are considered. |
| [**R4-2405765**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405765.zip) | TP adding 3MHz example combination CA\_n100-n101 | Ericsson | Includes harmonics and IMD analysis.  No Harmonic mixing issues of this combination.  There is no OOB exception for this CA combination.  Based on the table 1.2.2-1 there are no intermodulation products falling inside the RX bands.  There is no need to define additional REFSENS requirements. |
| [**R4-2405766**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405766.zip) | draft CR adding 3MHz example combination CA\_n100-n101 | Ericsson |  |

## Open issues summary

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

### Issue 2-1: NR CA configuration

* Background
  + The WID mentions example band combination as “CA/DC of 3MHz in band n100 and 5MHz or 10MHz in band n101”.
  + The WID does not explicitly specify whether UL CA shall be supported.
* Proposals
  + Proposal 1: Define the new inter-band CA operating band

|  |  |
| --- | --- |
| NR CA Band | NR Band |
| CA\_n100-n101 | n100, n101 |

* + Proposal 2: Define the new NR CA configuration and bandwidth combination sets for inter-band CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n100A-n101A | CA\_n100A-n101A | n100 | 3 | 0 |
| n101 | 5, 10 |  |

* + Proposal 3: Define the new NR CA configuration and bandwidth combination sets for inter-band CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n100A-n101A | CA\_n100A-n101A | n100 | 3, 5 | 0 |
| n101 | 5, 10 |  |

* + Proposal 4: Include both single UL and two simultaneous UL transmission in the UL configuration for the example band combination n100+n101.
  + Proposal 5: RAN4 to further clarify the scope of work especially on whether UL CA is considered.
  + Proposal 6: Specify band combinations with 1 CC/ band.
* Candidate options
  + Inter-band CA operating band
    - Option 1:

|  |  |
| --- | --- |
| NR CA Band | NR Band |
| CA\_n100-n101 | n100, n101 |

* + NR DL CA configuration
    - Option 1: CA\_n100A-n101A
  + NR UL CA configuration
    - Option 1: CA\_n100A-n101A
    - Option 2: single carrier only
  + Channel bandwidth per band in CA band combination
    - Option 1:

|  |  |
| --- | --- |
| NR Band | Channel bandwidth (MHz) |
| n100 | 3 |
| n101 | 5, 10 |

* + - Option 2:

|  |  |
| --- | --- |
| NR Band | Channel bandwidth (MHz) |
| n100 | 3, 5 |
| n101 | 5, 10 |

* Recommended WF
  + Define new inter-band CA operating band combination

|  |  |
| --- | --- |
| NR CA Band | NR Band |
| CA\_n100-n101 | n100, n101 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n100A-n101A | CA\_n100A-n101A | n100 | 3, [5] | 0 |
| n101 | 5, 10 |

ZTE: according to objective, channel bandwidth 5MHz is not considered.

CATT: Same observation. If the proponent wants to add 5MHz, they should be done in RAN.

Huawei: Remove 5MHz from n100.

Qualcomm: Is the intention to restrict which band is PCell in the band combination?

Verizon: Share the same observation as ZTE and CATT.

Intel: We think that we get request from operator to add 5MHz. We can agree first the combination with 3MHz. We can decide whether to include 5MHz in future. 3MHz can be on PCell or SCell.

Huawei: if the proponent wants to have 5MHz later on, they can add it in the basket WIs.

Moderator: to Huawei, the WI does not preclude 5MHz. It may have impact on RRM. It is beneficial to have band combinations with 5MHz.

Huawei: motivation of proponents is that they first use 3MHz. We need clarify with UIC. We should not take the hard decision against the WID.

Nokia: UIC wants to have 5MHz. They need request it in the WID.

Huawei: we can consider the basket WI.

Moderator: we cannot add it in basket since BCS1 will be used.

Agreement:

* + Define new inter-band CA operating band combination

|  |  |
| --- | --- |
| NR CA Band | NR Band |
| CA\_n100-n101 | n100, n101 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n100A-n101A | CA\_n100A-n101A | n100 | 3 | 0 |
| n101 | 5, 10 |

* + 5MHz bandwidth can be added for n100 in the band combination after RAN plenary agrees to add it in the WID

### Issue 2-2: NR DC configuration

* Proposals
  + Option 1: Define new inter-band DC configuration

|  |  |
| --- | --- |
| NR DC  configuration | Uplink NR DC  configuration |
| DC\_n100A-n101A | DC\_n100A-n101A |

* Recommended WF
  + Option 1

*Agreement:*

* + Define new inter-band DC configuration

|  |  |
| --- | --- |
| NR DC  configuration | Uplink NR DC  configuration |
| DC\_n100A-n101A | DC\_n100A-n101A |

### Issue 2-3: Transmission bandwidth configuration for 3MHz and 5MHz CBW for band n100

* Proposals
  + Proposal 1: RAN4 to further clarify the scope of work especially on … whether 12 and 20 RB transmission bandwidth configurations are considered.
* Candidate options
  + Option 1: Define requirements for the case for 12 and 20 RB transmission bandwidth configurations for 3MHz and 5MHz CBW, respectively.
  + Option 2: Define requirements for the case for 15 and 25 RB transmission bandwidth configurations for 3MHz and 5MHz CBW, respectively.
  + Option 3: Define RF requirements agnostic of transmission bandwidth configurations for 3MHz and 5MHz CBW (i.e., support 12, 15 and 20, 25 RB configurations for 3MHz and 5MHz CBW, respectively)
* Recommended WF
  + Further discuss in the meeting

Moderator: it may impact RRM.

Qualcomm: We can remove 5MHz, since we remove 5Mhz from n100. Wonder if operator wants to use 12 RBs.

CATT: for concept of transmission bandwidth configuration, it is clear. For 3MHz, it is 15 RB. For SSB, it is 12 RB. We do not need do anything on it.

Moderator: if no 12RB, there will be no impact on RRM.

Intel: we do not need this agreement to avoid the confusing.

Moderator: for 3MHz we have either 12 RB or 15 RBs.

ZTE: for band n100 3MHz, only 12 RB can be configured.

Huawei: Only 12 RB for certain sync raster points and we have also 15RB included.

CATT: For transmission bandwidth, it is clear that it is with 15RBs.

Qualcomm: There are a lot of confusion on it. We would like to postpone the discussion until the next meeting.

Ericsson: There is no difference to use 15 or 12. There is no impact on RF requirement. OK to postpone the decision.

Agreement:

* Define RF requirements agnostic of transmission bandwidth configurations for 3MHz CBW

### Issue 2-4: Power class for UL inter-band CA

* Background
  + PC3 and PC1 have been specified for band n100 and n101
  + The WID does not explicitly provide information on target PC
* Proposals
  + Proposal 1: It is necessary to discuss whether PC3 and PC1 can be defined for inter-band CA/DC with 3MHz CBW.
  + Proposal 2: Inter-band CA/DC of 3MHz in band n100 and 5MHz or 10MHz in band n101 should support PC3
* Candidate options
  + Option 1: PC3
  + Option 2: PC1
* Recommended WF
  + Define PC3 inter-band CA/DC combinations

**Moderator: PC1 is controversial. There is no consensus in RAN plenary. The plan is to come back to RAN in the late stage for PC1.**

**Huawei: For UIC, PC1 is very important.**

**LGE: For proposal 1, can we decide PC1 in RAN?**

**Agreement:**

* Define PC3 inter-band CA/DC combinations
* FFS on whether to define PC1 inter-band CA/DC combinations

### Issue 2-5: RF architectures

* Proposals
  + Proposal 1: For inter-band CA\_n100-n101, the possible RF architecture implementation can be assumed as is shown

A diagram of a network

Description automatically generated

* Recommended WF
  + Further discuss in the meeting

**ZTE: for inter-band CA, it is low FDD band + mediam TDD band.**

**Nokia: why is there is switch? Is there any other band?**

**ZTE: Yes. This is simple example. In general, for certain UE, it may support other bands.**

**Huawei: Why do we need architecture? What is the use case?**

**Qualcomm: We also think we do not need agreeing architecture.**

**CATT: this is for sharing antenna. There may be other implementation.**

**ZTE: to Huawei and Qualcomm, in my understanding, it is similar to other band combination work. If we want to define band combination. The requirement should be based on a certain architecture.**

**Huawei: no need to agree on such RF architecture.**

### Issue 2-6: Signalling aspects

* Proposals
  + Option 1: Do not introduce an optional capability indicating the support of CA/DC a band combination with 3MHz channel bandwidth in one of the bands in the band combination.
  + Option 2: Whether a new signalling of indicating inter-band non-collocated is required needs discussion.
  + Option 3: In case 12 and 20 RB extraordinary transmission bandwidth configurations are considered RAN4 should discuss required improvements in related signalling.
* Recommended WF
  + Postpone discussion to future meetings

### Issue 2-7: UE RF specification impact for inter-band CA (CA\_n100A-n101A) for TS 38.101-1

* Summary of proposals

|  |  |
| --- | --- |
| **Requirement** | **Required change for NR CA** |
| **General** | |
| 5.2A Operating bands | ZTE/Intel/UIC/QC/CATT/Ericsson: New inter-band CA operating band |
| 5.3 UE channel bandwidth | Huawei: Update section 5.3 to remove the restriction that limited 3MHz to single carrier case, only |
| 5.5A Configurations for CA | ZTE/Intel/UIC/QC/CATT/Ericsson: New NR CA configurations and bandwidth combinations sets for inter-band CA |
| **TX requirements** | |
| 6.2A.1 UE maximum output power for CA | ZTE/Nokia/QC/Ericsson: UE Power Class for uplink inter-band CA combination (Table 6.2A.1.3-1) |
| 6.2A.2 MPR for CA | No impact |
| 6.2A.3 A-MPR for CA | Intel: A-MPR for CA combination |
| 6.2A.4 Configured transmitted power for CA | ZTE/Nokia/Intel/Ericsson: ΔTIB,c for inter-band CA combination (Table 6.2A.4.2.3-1) |
| 6.3A Output power dynamics for CA | No impact |
| 6.4A Transmit modulation quality for CA | No impact |
| 6.5A Output RF spectrum emissions for CA | Nokia/QC: Spurious emissions for UE coexistence for CA combination (Table 6.5A.3.2.3-1) |
| **RX requirements** | |
| 7.3A.2 Reference sensitivity for CA | ZTE/QC/Intel/Nokia: ΔRIB,c for inter-band CA combination |
| 7.4A Max input level for CA | No impact |
| 7.5A Adjacent channel selectivity for CA | No impact |
| 7.6A Blocking characteristics for CA | Huawei: 7.6A.3.3: No update is needed, unless 3MHz is request for the following band combinations: CA\_n26-n77, CA\_n26-n78, CA\_n28-n46, CA\_n28-n77, CA\_n28-n78, CA\_n28-n79, CA\_n28-n102 |
| 7.7A Spurious response for CA | No impact |
| 7.8A Intermodulation characteristics for CA | No impact |
| 7.9A Spurious emissions for CA | No impact |
| 7.10A Power imbalance for CA | ZTE: Considering power imbalance parameters for non-co-located inter band CA\_n100-n101, 25 dB power imbalance can be reused. |

* Recommended WF
  + Define the following requirements for NR CA operation for CA\_n100A-n101A

|  |  |
| --- | --- |
| **Requirement** | **Required change for NR CA** |
| **General** | |
| 5.2A Operating bands | Inter-band CA operating band |
| 5.3 UE channel bandwidth | Update section 5.3 to remove the restriction that limited 3MHz to single carrier case, only |
| 5.5A Configurations for CA | New NR CA configurations and bandwidth combinations sets for inter-band CA |
| **TX requirements** | |
| 6.2A.1 UE maximum output power for CA | UE Power Class for uplink inter-band CA combination (Table 6.2A.1.3-1) |
| 6.2A.3 A-MPR for CA | FFS |
| 6.2A.4 Configured transmitted power for CA | ΔTIB,c for uplink inter-band CA combination (Table 6.2A.4.2.3-1) |
| 6.5A Output RF spectrum emissions for CA | Spurious emissions for UE coexistence for uplink inter-band CA combination (Table 6.5A.3.2.3-1) |
| **RX requirements** | |
| 7.3A.2 Reference sensitivity for CA | ΔRIB,c for inter-band CA combination (Table 7.3A.3.2.1-1) |
| 7.6A Blocking characteristics for CA | FFS |
| 7.10A Power imbalance for CA | FFS |

### Issue 2-8: UE RF specification impact for NR DC (DC\_n100A-n101A) for TS 38.101-1

* Summary of proposals

|  |  |
| --- | --- |
| **Requirement** | **Required change for NR CA** |
| **General** | |
| 5.5B Configurations for DC | ZTE: New NR DC configuration |
| **TX requirements** | |
| 6.2B.1 UE maximum output power for NR-DC | ZTE/Nokia: UE Power Class for uplink inter-band DC combination (Table 6.2B.1.3-1) |
| 6.2B.2 MPR for NR-DC | No impact |
| 6.2B.3 A-MPR for NR-DC | No impact |
| 6.2B.4 Configured transmitted power for NR-DC | No impact |

* + Proposal: Specify for DC\_n100-n101 the same requirements as for CA\_n100-n101
* Recommended WF
  + Define the following requirements for NR DC operation for DC\_n100A-n101A.

|  |  |
| --- | --- |
| **Requirement** | **Required change for NR DC** |
| **General** | |
| 5.5B Configurations for DC | New NR DC configurations |
| **TX requirements** | |
| 6.2B.1 UE maximum output power for NR-DC | UE Power Class for uplink inter-band DC combination (Table 6.2B.1.3-1) |

* + Other requirements for DC\_n100A-n101A are same as for CA\_n100-n101

### Issue 2-9: UE RF specification impact for inter-band DC for TS 38.101-3

* Candidate options
  + Option 1: No impact
  + Option 2:

|  |  |
| --- | --- |
| **NR UE single carrier Tx/Rx requirement with 3MHz CBW** | **Inter-band DC 38.101-3** |
| 7.3.2 Reference sensitivity power level | 7.3B.2.3: No need to update, unless there is an MSD on the required band combinations |
| 7.6.3 Out-of-band blocking | 7.6B.3.3: No update is needed, unless 3MHz is request for the following band combinations: DC\_26\_n77, DC\_26\_n78, DC\_26\_n79, DC\_28\_n77, DC\_28\_n78, DC\_28\_n79 |

* Recommended WF
  + Further discuss in the meeting

### Issue 2-10: Configured transmitted power for Inter-band CA: ΔTIB,c

* Candidate options
  + Option 1: ΔTIB,c = [0.3] dB
* Recommended WF
  + Further discuss in the meeting

### Issue 2-11: Reference sensitivity: ΔRIB,c

* Candidate options
  + Option 1: ΔRIB,c = 0 dB
* Recommended WF
  + Further discuss in the meeting

### Issue 2-12: Reference sensitivity: MSD requirements

* Proposals
  + Proposal 1: For inter-band CA\_n100-n101, no MSD issue needs to be discussed.
  + Proposal 2: The MSD requirements for harmonic, harmonic mixing, intermodulation and cross band isolation should be defiend for inter-band CA/DC with 3MHz according to co-existence study.
  + Proposal 3: New MSD table for PC1 should be added to spec, if PC1 inter-band CA/DC with 3MHz CBW is specified.
  + Proposal 4: The relaxed assumption for MSD analysis is needed, if PC1 inter-band CA/DC with 3MHz CBW is specified.
* Candidate options
  + Option 1: No MSD relaxations are needed
  + Option 2: FFS
* Recommended WF
  + No MSD relaxations are needed

### Issue 2-13: CR handling

* Recommended WF
  + Postpone CRs to future meetings
  + Follow the work plan for CR submissions

### Issue 2-14: TP handling

* Background
  + TP R4-2405765 was submitted
  + The WID does not include affected existing or new TRs
* Recommended WF
  + Further discuss in the meeting how to handle TPs

# Topic #3: Regulations for multi-carrier operation in bands n100/n101

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2405912**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405912.zip) | Huawei, HiSilicon, Vodafone, Orange, Telia Company, Telefónica, Deutsche Telekom | **Observation 1:** RAN4 requirements for n100 and n101 in Rel-17/18 were assuming single carrier operation.  **Proposal 1:** Agree on the understanding that “multiple carriers” wording in ECC Decision (20)02 applies to FRMCS BS operation with multiple single-carriers (non-CA), or in CA scenario.  **Proposal 2:** In case of lack of consensus on Proposal 1 wording, send LS to ECC/CEPT asking for clarification of the “multiple carriers” wording.  **Proposal 3:** Add multi-carrier clarification to Rel-17 BS specifications TS 38.104 and TS 38.141-1, based on ECC (20)02 wording, i.e. CEPT administrations wishing to allow multiple carriers should consider implementation of a coordination procedure or other mitigation measures. |
| [**R4-2405913**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405913.zip)R4-2405914 | Huawei, HiSilicon | Draft CR to TS 38.104. Provides clarification on the multiple carrier operation for FRMCS BS operation in bands n100 and/or n101 based on discussion in R4-2405912. |
| [**R4-2405915**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_110bis/Docs/R4-2405915.zip)R4-2405916 | Huawei, HiSilicon | Draft CR to TS 38.141-1. Provides clarification on the multiple carrier operation for FRMCS BS operation in bands n100 and/or n101 based on discussion in R4-2405912. |

## Open issues summary

Background: ECC (20)02 includes the following statement for multi-carrier operation

|  |
| --- |
| *Decides*  *4.* ***that CEPT administrations wishing to allow multiple carriers using wideband technologies*** *(i.e., LTE or NR, including NB-IoT) or higher e.i.r.p. for RMR BS than stated in the technical conditions* ***should consider the implementation of a coordination procedure or other mitigation measures****;* |

*Open issues and candidate options before meeting:*

### Issue 3-1: Applicable Release and WI to handle the discussion

* Background
  + Based on proposals R4-2405912 the problem is related to the regulations for bands n100/n101, which were introduced in the past releases.
  + The associated Draft CRs propose to introduce the changes from Rel-17
* Recommended WF
  + Further discus the issues of regulations for multi-carrier operation in bands n100/n101 as a part of Rel-17 RF spectrum maintenance work

### Issue 3-2: Interpretation of ECC regulations on multi-carrier operation

* Candidate proposals
  + Proposal 1: Agree on the understanding that “multiple carriers” wording in ECC Decision (20)02 applies to FRMCS BS operation with multiple single-carriers (non-CA), or in CA scenario.
  + Proposal 2: In case of lack of consensus on Proposal 1 wording, send LS to ECC/CEPT asking for clarification of the “multiple carriers” wording.
  + Proposal 3: Add multi-carrier clarification to Rel-17 BS specifications TS 38.104 and TS 38.141-1, based on ECC (20)02 wording, i.e. CEPT administrations wishing to allow multiple carriers should consider implementation of a coordination procedure or other mitigation measures.
* Candidate options
  + Option 1: “multiple carriers” wording in the ECC Decision (20)02 applies to FRMCS BS operation in multiple single-carrier (non-CA) scenario (e.g. n101: 2x-5MHz), or in CA scenario,
  + Option 2: “multiple carriers” wording in the ECC Decision (20)02 applies to FRMCS BS operation in non-CA scenario including inter-band case (e.g. n100: 1x-5MHz + n101: 1x-5MHz; or 1x-5MHz + n101: 1x-10MHz), or in CA scenario,
  + Option 3: “multiple carriers” wording in the ECC Decision (20)02 applies to FRMCS BS operation in CA scenario only.
  + Option 4: The Decides 4 in ECC DEC(20)02 applies only to the case where more than 1 carrier is used in band n100 or n101. In the discussions in ECC that led to DEC(20)02 the case of using e.g. a 5MHz LTE or NR carrier together with an IoT carrier has been addressed; this has led to the Decides 4 text. This means that “multiple carrier” does not apply to using a single carrier in n100 plus a single carrier in n101 nor to the CA/DC case.
  + Option 5: send LS to ECC/CEPT asking for clarification of the “multiple carriers” wording.
* Recommended WF
  + Further discuss in the meeting

Huawei: we would like to provide the WF that we should capture the exact wording from ECC (20)02. We may not need handle it in this week.

Qualcomm: before agreeing the WF, it is good to clarify multiple carriers. It is for administrator.

Huawei: you use the same argument to capture part of requirement. Full transparent is needed.

Nokia: Operators have already clarified in the email. UIC cannot join the discussion.

Vodafone: agree with Huawei. It is better to capture it.

Moderator: suggest to have two WFs.

### Issue 3-3: CR handling

* R4-2405913/R4-2405914 Huawei, HiSilicon Draft CR to TS 38.104
* R4-2405915/R4-2405916 Huawei, HiSilicon Draft CR to TS 38.141-1
* Note: the CR handling depends on the decision on Issue 3-2.