**3GPP TSG-RAN WG4 Meeting # 104-e R4-2214228**

**Electronic Meeting, 15 – 26 August 2022**

**Agenda item:** 9.14.9

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [104-e][110] NR\_ext\_to\_71GHz\_Part\_1

**Document for:** Information

# Introduction

*This document captures RAN4 discussions on general aspects and system parameters of the NR extension to 71GHz work item. The covered agenda items are: 9.14.1, 9.14.2 and 9.14.3.3.*

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Nokia | Toni Lähteensuo | Toni.h.lahteensuo (at) nokia.com |
| Ericsson | Esther SienkiewiczChristian Bergljung | Esther.Sienkiewicz@ericsson.comChristian.Bergljung@ericsson.com |
| Huawei  | Michal Szydelko | Michal.szydelko@huawei.com |
| Apple | Steven Chen | steven.x.chen AT apple.com |
| Intel | Aida Vera Lopez | Aida.l.vera.lopez@intel.com |
| Xiaomi | Rui Zhou | zhourui1@xiaomi.com |
| Charter Communications Inc | Frank Azcuy | Frank.Azcuy@charter.com |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e., Company A (XX, XX)

# Topic #1: General

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2212118**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212118.zip)UE feature list and general aspects for NR ext. to 71GHz | Intel Corporation | *UE feature for NR ext. to 71GHz***Proposal 1:** Adopt the improved ON/ON transient period feature listed in Table 1 for NR\_ext\_to\_71GHz*Concluding NR ext. to 71GHz***Observation 1:** RAN4 should aim to reach consensus or tentative agreements for the remaining single-carrier requirements. Confirming tentative agreements and minor revisions can be handled in the maintenance stage.**Observation 2:** Alignment is needed to decide on the best approach to take to ensure a band combination for the case of FR2-2 DC/CA with an anchor in FR1 case is defined. A potential option is detailed below:* RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
* Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
* To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase
 |
| **[R4-2213231](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213231.zip)**SSB side conditions for band n263*Note: Beam correspondence is covered in* [*thread [111]*](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B111%5D%20NR_ext_to_71GHz_Part_2) | Apple Inc. | *Beam correspondence conditions for SSB based L1-RSRP and CSI-RS based L1-RSRP measurements***Proposal 1:** RAN4 shall apply the minimum SSB and minimum CSI-RS as provided in Table 1 and Table 2 for band n263.Table 1: Conditions for SSB based L1-RSRP measurements for beam correspondence

|  |  |
| --- | --- |
| **Band** | **Minimum SSB (dBm/SCSSBB)** |
| n257 | -96.2 |
| n258 | -96.2 |
| n259 | -90.7 |
| n260 | -91.9 |
| n261 | -96.2 |
| n262 | -88.5 |
| n263 | -88.2 |

Table 2: Conditions for CSI-RS based L1-RSRP measurements for beam correspondence

|  |  |
| --- | --- |
| **Band** | **Minimum CSI-RS (dBm/SCSSBB)** |
| n257 | -96.2 |
| n258 | -96.2 |
| n259 | -90.7 |
| n260 | -91.9 |
| n261 | -96.2 |
| n262 | -88.5 |
| n263 | -88.2 |

 |
| [**R4-2213370**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213370.zip)Draft reply LS on the minimum guard period between two SRS resources for antenna switching | Huawei, HiSilicon | *LS reply content***Question to RAN4:** How many symbol(s) is/are needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz respectively, in FR2-2?**Answer to RAN1:** The SRS antenna switching time is 15us for both 480 and 960 kHz in FR2-2. The minimum guard time needed to accommodate the required antenna switching time could be calculated as 7.2 symbols for 480kHz SCS and 14.4 symbols for 960kHz SCS, which are rounded up in below table. RAN1 could further discuss and determine on the final values.**Table 6.2.1.2-1:** The minimum guard period between two SRS resources of an SRS resource set for antenna switching

|  |  |  |
| --- | --- | --- |
|  |  | ***Y* [symbol]** |
| 0 | 15 | 1 |
| 1 | 30 | 1 |
| 2 | 60 | 1 |
| 3 | 120 | 2 |
| 5 | 480 | 8 |
| 6 | 960 | 15 |

 |
| **[R4-2211697](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211697.zip)**Reply LS for the minimum guard period between two SRS resources for antenna switching | CATT | *LS reply content***Question to RAN4:** How many symbol(s) is/are needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz respectively, in FR2-2?**Answer from RAN4:** The absolute switching time for FR2-2 is the same as the capability evaluated in R15, i.e., the antenna switching time is 15 µsec. The detail evaluation results for every possible switching scenario are included in the R15 reply LS R4-1710048 [1]. The decision on the symbol(s) needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz SCS is up to RAN1 discussion based on the absolute switching time in R4-1710048. |

## Open issues summary

### Sub-topic 1-1: UE feature list

*An optional capability for improved ON/ON transient period is proposed in R4-2212118*

**Issue 1-1: Improved ON/ON transient period feature**

* Recommended WF
	+ Please provide your feedback on this feature to the [**Rel-17 UE feature list thread [141]**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B141%5D%20R17_feature_list)
	+ Note that ON/ON transient period for 480 and 960 kHz SCS is part of [**thread [111] NR\_ext\_to\_71GHz\_Part\_2**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B111%5D%20NR_ext_to_71GHz_Part_2). Please share your comments for this topic in that thread.

### Sub-topic 1-2: LS reply to RAN1

*RAN4 received an LS from RAN1 with the following question (R1-2200796):*

**Question to RAN4**: How many symbol(s) is/are needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz respectively, in FR2-2?

For reference, the following was specified in Rel-15 (38.214 Section 6.2.1.2) for subcarrier spacing $∆f$ up to 120 kHz:

**Table 6.2.1.2-1: The minimum guard period between two SRS resources of an SRS resource set for antenna switching**

|  |  |  |
| --- | --- | --- |
|  |  | ***Y* [symbol]** |
| 0 | 15 | 1 |
| 1 | 30 | 1 |
| 2 | 60 | 1 |
| 3 | 120 | 2 |

**Issue 1-2: LS reply to RAN1**

* Proposals
	+ Option 1: CATT, R4-2211697
		- **Answer from RAN4:** The absolute switching time for FR2-2 is the same as the capability evaluated in R15, i.e., the antenna switching time is 15 µsec. The detail evaluation results for every possible switching scenario are included in the R15 reply LS R4-1710048 [1]. The decision on the symbol(s) needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz SCS is up to RAN1 discussion based on the absolute switching time in R4-1710048.
	+ Option 2: Huawei, R4-2213370
		- **Answer to RAN1:** The SRS antenna switching time is 15us for both 480 and 960 kHz in FR2-2. The minimum guard time needed to accommodate the required antenna switching time could be calculated as 7.2 symbols for 480kHz SCS and 14.4 symbols for 960kHz SCS, which are rounded up in below table. RAN1 could further discuss and determine on the final values.
* Recommended WF
	+ Companies are encouraged to provide comments on the specific wording and content of the LS reply. Draft LS reply R4-2211697 can be taken as baseline and updated based on feedback received.

## Companies views’ collection for 1st round

### Open issues

Issue 1-1: UE feature list

* Please provide feedback for improved ON/ON transient period feature to the dedicated [**Rel-17 UE feature list thread [141]**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B141%5D%20R17_feature_list)
* Comments for improved ON/ON transient period topic should be provided to [**thread [111] NR\_ext\_to\_71GHz\_Part\_2**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B111%5D%20NR_ext_to_71GHz_Part_2)

Issue 1-2: LS reply to RAN1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Vivo | Option 1 and Option 2 share the same understanding that the antenna switching time is 15 µsec. Both of these two options are OK for us. |
| OPPO | Option 1 and 2. If there is interest to improve the values, probably should provide alternatives. |
| Ericsson | Scaling based on 15 us from Rel-15 is straightforward for RAN1. Now, RAN1 asked RAN4 for an assessment of the required guard based on a state-of-the-art switching-time value considering the consequences of scaling guard symbols by 8/15.Has the impact on the SRS functionality of Y = 8/15 been analyzed?RAN4 has not yet agreed upon a transient time for SRS antenna switching or a transient-time capability for FR2-2. Scaling the 120 kHz guard symbols to Y = 8/15 for 480/960 kHz would not be feasible from a functionality standpoint, e.g. a 16 symbol guard time would mean that it is not possible to put two SRS resources in the same slot, only even if the UE supports the Rel-16 feature group that allows SRS resources to be located in any OFDM symbol of the slot. Should Y = 8/15 symbols be specified for 480/960 kHz in 38.214, then the UE should support the Rel-17 feature group that enables aperiodic SRS resources for antenna switching located in different slots if it supports 480/960 kHz. A further reduction of the guard period Y for 480/960 kHz should be subject to additional transient-time capability to be specified by RAN4. |
| Apple | We are OK with either option 1 or option 2. |
| Xiaomi | Option 1 and 2 are both ok with the 15us antenna switching. |

### CRs/TPs comments collection

*N/A*

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1-1: UE feature list** | **Issue 1-1: Improved ON/ON transient period feature***No consensus has been reached for ON/ON transient period in thread [111].**Recommendations for 2nd round:**Continue ON/ON transient period discussions in* [***thread [111]***](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B111%5D%20NR_ext_to_71GHz_Part_2) |
| **Sub-topic #1-2: LS reply to RAN1** | **Issue 1-2: LS reply to RAN1***Candidate options:** + Option 1: CATT, R4-2211697
		- **Answer from RAN4:** The absolute switching time for FR2-2 is the same as the capability evaluated in R15, i.e., the antenna switching time is 15 µsec. The detail evaluation results for every possible switching scenario are included in the R15 reply LS R4-1710048 [1]. The decision on the symbol(s) needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz SCS is up to RAN1 discussion based on the absolute switching time in R4-1710048.
	+ Option 2: Huawei, R4-2213370
		- **Answer to RAN1:** The SRS antenna switching time is 15us for both 480 and 960 kHz in FR2-2. The minimum guard time needed to accommodate the required antenna switching time could be calculated as 7.2 symbols for 480kHz SCS and 14.4 symbols for 960kHz SCS, which are rounded up in below table. RAN1 could further discuss and determine on the final values.

*Majority view is that 15 µs can be reported for SRS antenna switching time and that either Option 1 or Option 2 are ok. However, a point was raised on whether the impact on SRS functionality of Y = 8/15 has been analyzed.**Recommendations for 2nd round:**Continue discussion and aim to align on aspects needed in our answer. Use Option 1 as baseline for LS reply and further discuss edits and specific wording for the reply.* |

## Discussion on 2nd round

**Issue 1-1: Improved ON/ON transient period feature**

*Please continue ON/ON transient period discussions in* [***thread [111]***](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B111%5D%20NR_ext_to_71GHz_Part_2)

**Issue 1-2: LS reply to RAN1**

*Use Option 1 (CATT, R4-2211697) as baseline and further align on aspects to include in the reply, as well as the wording in the dedicated email thread below:*

* *[104-e][110] NR\_ext\_to\_71GHz\_Part\_1 – Reply LS on minimum guard period*

## Companies views’ collection for 2nd round

### Open issues

Issue 1-1: UE feature list 🡪 Provide comments for improved ON/ON transient period in [**thread [111]**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B111%5D%20NR_ext_to_71GHz_Part_2)

Issue 1-2: LS reply to RAN1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| HW | The 15 us transient period is derived based on the hardware limitation. Based on the majority view, no improvement could be seen at this stage. If the concern is potential impact on RAN1 process based on Ericsson’s comment, we might need to reply this RAN1 LS as early as possible so that RAN1 experts could have time to do the analysis. |

## Summary for 2nd round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1-1: UE feature list** | **Issue 1-1: Improved ON/ON transient period feature***To be updated based on outcome of GTW discussions for thread [111]* |
| **Sub-topic #1-2: LS reply to RAN1** | **Issue 1-2: LS reply to RAN1***Recommended WF:**Discuss in GTW session* |

# Topic #2: Operation bands and system parameters

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2211873**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211873.zip)Remaining issues on system parameters for NR operation in 52.6GHz - 71GHz | Apple Inc. | *Unlicensed operation***Proposal 1:** RAN4 to agree on either Alt. 1 or Alt. 2 for Table 5.2-1.* Alt. 1: NOTE 1: This band is for unlicensed operation
* Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations

*Channel spacing for CA***Proposal 2:** For NR operating bands in FR2-2, nominal channel spacing is when the center frequencies of two closest channels are multiple of 100.8MHz or multiple of 100.8MHz plus 50.4MHz and the two channels do not overlap. Note CA of 2000MHz CBW with another CBW is not considered. |
| [**R4-2212845**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212845.zip)Contiguous DL CA system parameters for FR2-2 | Nokia, Nokia Shanghai Bell. | *BS channel bandwidth for CA***Observation 1:** No changes are needed to clause 5.3A BS channel bandwidth for CA in TS 38.104.*Channel spacing***Observation 2:** Nominal channel spacing for adjacent carriers and nominal spacing for CA are the same in FR2-2*Channel raster***Proposal 1:** Specify channel spacing for adjacent NR carriers and channel spacing for CA using the following rules:1. Channel centers are integer multiple of 100.8 MHz apart and
2. Channels are centered at closest available RF raster point with no overlap between carriers.

*Operating bands for CA***Proposal 2:** Add NR CA band CA\_n263 to table 5-2A.1-1 in TS 38.101-2 together with a note clarifying that only contiguous CA is applicable for this band.

|  |  |
| --- | --- |
| NR CA Band | NR Band(Table 5.2-1) |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 (Note) | n263  |
| NOTE: Only contiguous CA is applicable for this operating band. |

*UE channel bandwidth for CA***Proposal 3:** In Rel-17 only support for n\*100 MHz and m\*400 MHz contiguous CA is specified. **Proposal 4:** No new bandwidth classes are specified for n\*100 MHz**Observation 3:** CA bandwidth classes G, H, I, J, K, L, and M belonging to fallback group 3 are sufficient to cover 8x100 MHz CA.**Proposal 5:** Two new bandwidth classes are specified and placed within fallback group 1 to cover 4\*400 MHz and 5\*400 MHz. These new bandwidth classes are applicable only for FR2-2.

|  |  |  |  |
| --- | --- | --- | --- |
| **NR CA BW class** | **Aggregated channel bandwidth** | **# of cont. CC** | **Fallback group** |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4,5 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |
| V (Note 4) | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |
| W (Note 4) | 1600 MHz < BWChannel\_CA ≤ 2000 MHz | 5 |
| NOTE 3: In this release of the specification, the minimum requirements for intra-band contiguous CA configurations apply for aggregated channel bandwidths up to 1600 MHz for FR2-1 (this note is not relevant for UE capability parsing by the network).NOTE 4: In this release of the specification, this bandwidth class is applicable only for operating bands within FR2-2. |

*Channel arrangement for CA***Proposal 6:** Align channel spacing for CA for FR2-2 between TS 38.104 and TS 38.101-2.*Configurations for CA***Proposal 7:** Include CA configurations up to 5\*400 MHz and 8\*100 MHz.**Proposal 8:** Include a note in CA configuration table to clarify that only multiples of the same channel bandwidth are allowed for FR2-2. |

## Open issues summary

### Sub-topic 2-1: FR2 band for unlicensed operation

**Issue 2-1: Note on unlicensed operation**

* Proposal (Apple, R4-2211873)
	+ RAN4 to agree on either Alt. 1 or Alt. 2 for Table 5.2-1.
		- Alt. 1: NOTE 1: This band is for unlicensed operation
		- Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations
* Recommended WF
	+ Companies are encouraged to provide feedback on the two alternatives listed to capture the unlicensed operation of band n263

### Sub-topic 2-2: Operating bands and channel arrangement for CA

**Issue 2-2a: Operating bands for CA**

* Proposal (Nokia, R4-2212845)
	+ Add NR CA band CA\_n263 to table 5-2A.1-1 in TS 38.101-2 together with a note clarifying that only contiguous CA is applicable for this band.

|  |  |
| --- | --- |
| NR CA Band | NR Band(Table 5.2-1) |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 (Note) | n263  |
| NOTE: Only contiguous CA is applicable for this operating band. |

* Recommended WF
	+ Companies should share their views on the proposal and note wording. Agreement will be captured in a CR for TS 38.101-2.

**Issue 2-2b: NR CA bandwidth class**

* Proposals (Nokia, R4-2212845)
	+ Proposal 1: In Rel-17 only support for n\*100 MHz and m\*400 MHz contiguous CA is specified.
	+ Proposal 2: No new bandwidth classes are specified for n\*100 MHz
	+ Proposal 3: Two new bandwidth classes are specified and placed within fallback group 1 to cover 4\*400 MHz and 5\*400 MHz. These new bandwidth classes are applicable only for FR2-2.

|  |  |  |  |
| --- | --- | --- | --- |
| **NR CA BW class** | **Aggregated channel bandwidth** | **# cont. CC** | **Fallback group** |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4,5 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |
| V (Note 4) | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |
| W (Note 4) | 1600 MHz < BWChannel\_CA ≤ 2000 MHz | 5 |
| NOTE 3: In this release of the specification, the minimum requirements for intra-band contiguous CA configurations apply for aggregated channel bandwidths up to 1600 MHz for FR2-1 (this note is not relevant for UE capability parsing by the network).NOTE 4: In this release of the specification, this bandwidth class is applicable only for operating bands within FR2-2. |

* Recommended WF
	+ Companies should share their views on the three proposals listed, including how the proposed CA bandwidth classes are captured in the above table.

**Issue 2-2c: Channel spacing for CA**

* Proposals
	+ Proposal 1: For NR operating bands in FR2-2, nominal channel spacing is when the center frequencies of two closest channels are multiple of 100.8MHz or multiple of 100.8MHz plus 50.4MHz and the two channels do not overlap. Note CA of 2000MHz CBW with another CBW is not considered. (Apple, R4-2211873)
	+ Proposal 2: Specify channel spacing for adjacent NR carriers and channel spacing for CA using the following rules: (Nokia, R4-2212845)
		- Channel centers are integer multiple of 100.8 MHz apart and
		- Channels are centered at closest available RF raster point with no overlap between carriers
	+ Proposal 3: Align channel spacing for CA for FR2-2 between TS 38.104 and TS 38.101-2. (Nokia, R4-2212845)
* Recommended WF
	+ Companies are encouraged to provide feedback on the three proposals listed
	+ Note that this issue can be sub-divided into two parts: channel spacing for adjacent carriers and the definition of contiguous CA
		- Proposal 1 and Proposal 2 are aligned on channel spacing for adjacent carriers
		- For contiguous CA definition, revisions may be needed

**Issue 2-2d: Configurations for intra-band contiguous CA**

* Proposals (Nokia, R4-2212845)
	+ Proposal 1: Include CA configurations up to 5\*400 MHz and 8\*100 MHz.
	+ Proposal 2: Include a note in CA configuration table to clarify that only multiples of the same channel bandwidth are allowed for FR2-2.

| NR CA configuration / Bandwidth combination set / Fallback group |
| --- |
| NR CA configs. | Uplink CA configs. | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | Max aggregatedBW (MHz) | BCS | Fallback group |
| CA\_n263B | CA\_n263A | 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n263C | CA\_n263A | 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 | 1 |
| CA\_n263V | CA\_n263A | 400 | 400 | 400 | 400 |  |  |  |  | 1600 | 0 | 1 |
| CA\_n263W | CA\_n263A | 400 | 400 | 400 | 400 | 400 |  |  |  | 2000 | 0 | 1 |
| CA\_n263G | CA\_n263A | 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n263H | CA\_n263A | 100 | 100 | 100 |  |  |  |  |  | 300 | 0 | 3 |
| CA\_n263I | CA\_n263A | 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 | 3 |
| CA\_n263J | CA\_n263A | 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 | 3 |
| CA\_n263K | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 | 3 |
| CA\_n263L | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 | 3 |
| CA\_n263M | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 | 3 |
| NOTE 1: VoidNOTE 2: For the NR CA configuration with more than two component carries, the bandwidths in a BCS which may introduce combinations more than requested unintentionally should be listed in a row separately.NOTE 3: In this release of the specification, contiguous DL CA configurations within FR2-2 may only contain multiples of the same channel bandwidth.  |

* Recommended WF
	+ Companies should share their views on the proposed configurations captured in the above table

## Companies views’ collection for 1st round

### Open issues

Issue 2-1: Note on unlicensed operation

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc | We agree with Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations |
| vivo | We prefer Alt. 2. |
| OPPO | For clarification, what is the meaning of “and subject to regional and/or country specific regulations”? Does it mean there will be additional requirements defined by regional/country specific regulations or means this band can be used as unlicensed band per regional/country specific regulations? |
| Nokia | Both options would be fine for us. Alt2 has been used previously and for consistency the same could be done here. |
| Ericsson | Alt 2. We agree the need for a note in Table 5.2-1 to identify unlicensed operation. To keep consistency throughout specifications, would it not make sense to have the notes aligned for all unlicensed operation and therefore same wording as n96 in TS 38.104? |
| Huawei | We also prefer option 2, over option 1. Note text alignment with the other unlicensed bands already specified is also preferred.  |
| Apple | We are OK with Alt. 2 if it is the majority view. To Ericsson: the use of “shared spectrum access” in the note was discussed and there was concern that in some regions, LBT is not mandatory so “shared spectrum access” is not accurate. Other comments/views are welcome.To OPPO: in our understanding, “and subject to regional and/or country specific regulations” covers the cases where LBT is or is not mandatory, among other specific regulations such as the available spectrum. |
| Intel | Existing specifications have the following notes for unlicensed band n96 in the NR operating bands table:* **NOTE 13** in 38.101-1 or **NOTE 3** in 38.104: This band is restricted to operation with shared spectrum channel access as defined in TS 37.213.
* **NOTE 14** in 38.101-1 or **NOTE 4** in 38.104: This band is applicable only in countries/regions designating this band for shared-spectrum access use subject to country-specific conditions

We think it is better to align the new note’s wording with the language used in Note 13. Therefore, our preference for the n263 note is:* NOTE XX: This band is restricted to operation with shared spectrum channel access as defined in TS 37.213 [reference for 37.213].

At a minimum, we should use ‘shared spectrum channel access’ instead of ‘unlicensed operation’ since the term ‘unlicensed operation’ is not used in the current specification. |
| Xiaomi | Support alt.2. |

Issue 2-2a: Adding n263 to Operating bands for CA table

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We support adding CA\_n263 (the note is not needed since all configurations in the table are contiguous) |
| Huawei | @Ericsson: section 5.2A.1 covers both cont and non-cont CA, as explicitly stated on the table’s header. Therefore the clarification note seems justified.  |
| Apple | Our view is that such changes to the specification can only be added after all the relevant RF requirements, especially on the UE side, are completed. |
| Intel | We agree to include CA\_n263 in Table 5-2A.1-1 if the definition for “contiguous CA” is updated so it can reflect CA between nearly adjacent carriers |

Issue 2-2b: NR CA bandwidth class

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We agree with Proposal 1, Proposal 2 and Proposal 3. Then FBG1 is maintained as a n x 400 MHz class, which is consistent with the intended use of contiguous intra-band CA for n263. |
| Huawei | Proposal 1: ok as tentative agreement. We would like to double-check in second round.Proposal 2: as FR2-2 extended the upper boundary of the aggregated channel bandwidth, this proposal does not seem to be necessary, actually. Proposal 3; in Note 4, the wording “In this release of the specification” introduced ambiguity. It suggests, that we may extend FR2-1 aggregated BWs in future, which is not intended and was not discussed in this WI. |
| Apple | In FR2-1, there is also a proposal to add one more CA BW class to FBG1 to increase aggregated BW up to 1600 MHz. As FR2-1 CA BW classes are still evolving, it would be better to discuss the new CA BW classes for FR2-2 together with FR2-1. |
| Intel | New classes are needed, and we support adding these. As Apple noted, we should consider FR2-1 discussion as well. |

Issue 2-2c: Channel spacing for CA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Proposal 1: the CA spacing for contiguous 100 MHz carriers can be 100.8 MHzProposal 2: aligned with Proposal 1 for carriers of 100 MHz bandwidth. If the CA spacing is less than (if applicable) or equal to the nominal, then the configuration is contiguous.Proposal 3: agreed. |
| Apple | The difference between proposal 1 and proposal 2 is proposal 1 considers CA of difference CBWs such as 100+400MHz.Proposal 3 seems reasonable.  |
| Intel | Overall, we are supportive of all proposals. However, we think it is beneficial to formulate the definition closer to how they are currently captured in specifications.*Nominal channel spacing*Adjacent channel spacing can be expressed in compact form below for FR2-2 operating bands:Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8 MHz) \* (100.8/2) [MHz]*Channel spacing for CA*Since contiguous CA is intended for CA between adjacent carriers, we can simply re-use the nominal channel spacing for adjacent carrier captured above. |

Issue 2-2d: Configurations for intra-band contiguous CA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Comm Inc. | For 2.2b, We agree with Proposal 3: Two new bandwidth classes are specified and placed within fallback group 1 to cover 4\*400 MHz and 5\*400 MHz. These new bandwidth classes are applicable only for FR2-2.For 2.2d, we agree with Proposal 2: Include a note in CA configuration table to clarify that only multiples of the same channel bandwidth are allowed for FR2-2. |
| Nokia | Apart from issue 2-2c all proposals come from us.For issue 2-2c, the channel spacing depends whether CA between different channel bandwidths is allowed in this release. Multiple of 100.8 + 50.4 MHz is needed only in case 100 MHz is aggregated with other channel bandwidths. Regarding the Apple proposal, the wording could be improved on the “two closest channels” to make it more obvious that closest *available* raster point needs to be used without causing overlap, i.e. there cannot be empty channels in between the “closest” carriers.Draft CRs should be assigned to capture the CA system parameters to both TS 38.101-2 and TS 38.104 |
| Ericsson | Proposal 1 agreed, preferably with the amendment discussed for Issue 2-2b. |
| Apple | We are OK to discuss the draft CR directly, as it is probably more efficient. However, as said, such CR should not be implemented into the specification until all the RF requirements are completed. |
| Intel | Content of Proposal 1 is agreeable and had been discussed previously (R4-2202365).The NR CA configuration table should be updated to reflect the outcome of Issue 2-2b. |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#2-1: Unlicensed FR2 band** | **Issue 2-1: Note on unlicensed operation***Candidate options:** + Alt. 1: NOTE 1: This band is for unlicensed operation
	+ Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations
	+ Alt. 3: NOTE 1: This band is restricted to operation with shared spectrum channel access as defined in TS 37.213 [reference for 37.213].

*Recommendations for 2nd round:**Companies are encouraged to align on suitable wording for the note. Consider whether a combination of Alt. 2 and Alt. 3 is agreeable.* |
| **Sub-topic#2-2: Operating bands and channel arrangement for CA** | **Issue 2-2a: Operating bands for CA***Agreement reached in GTW session – Aug. 18th:***Agreement:*** If all the UE CA requirements are finalized,
	+ Add NR CA band CA\_n263 to table 5-2A.1-1 in TS 38.101-2 together with a note clarifying that only contiguous CA is applicable for this band.

|  |  |
| --- | --- |
| **NR CA Band** | **NR Band****(Table 5.2-1)** |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 (Note) | n263  |
| NOTE: in the current release, only contiguous CA is applicable for this operating band. |

**Issue 2-2b: NR CA bandwidth class***Agreement reached in GTW session – Aug. 18th:***Agreement:*** No new bandwidth classes are specified for n\*100 MHz
* The discussion on the new channel bandwidth classes for FR2-2 is allowed in the maintenance of this WI.

**Issue 2-2c: Channel spacing for CA***Candidate option:**Nominal channel spacing*Adjacent channel spacing can be expressed in compact form below for FR2-2 operating bands:Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8 MHz) \* (100.8/2) [MHz]*Channel spacing for CA*Since contiguous CA is intended for CA between adjacent carriers, we can simply re-use the nominal channel spacing for adjacent carrier captured above.*Recommendations for 2nd round:**Confirm whether the candidate option is agreeable and provide any edits if needed.***Issue 2-2d: Configurations for intra-band contiguous CA***This issue is related to Issue 2-2b and therefore can also be discussed during maintenance stage* |

### CRs/TPs

*Recommendations for new CRs to capture relevant system parameter agreements are found in* [***Section 4.1***](#_1st_round)*.*

## Discussion on 2nd round

**Issue 2-1: Note on unlicensed operation**

*Companies are encouraged to align on suitable wording for the note. Consider whether a combination of Alt. 2 and Alt. 3 is agreeable.*

* Candidate options:
	+ Alt. 1: NOTE 1: This band is for unlicensed operation.
	+ Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations.
	+ Alt. 3: NOTE 1: This band is restricted to operation with shared spectrum channel access as defined in TS 37.213 [reference for 37.213].

**Issue 2-2b: NR CA bandwidth class**

*Companies may share any additional feedback on NR CA bandwidth classes for FR2-2*

**Issue 2-2c: Channel spacing for CA**

*Companies are invited to discuss whether the candidate option below is agreeable*

* Candidate option:
	+ Nominal channel spacing

Adjacent channel spacing can be expressed in compact form below for FR2-2 operating bands:

Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8 MHz) \* (100.8/2) [MHz]

*Channel spacing for CA*

Since contiguous CA is intended for CA between adjacent carriers, we can simply re-use the nominal channel spacing for adjacent carrier captured above.

## Companies views’ collection for 2nd round

### Open issues

Issue 2-1: Note on unlicensed operation

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc | We prefer Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations. |
| Apple | We support Alt. 2, as it is important to acknowledge this band for unlicensed operation. Regarding Alt. 3, RAN4 never used the wording “shared spectrum channel access as defined in TS 37.213”. RAN4 needs to ensure compliance with regulation, not RAN1 TS. |
| Intel | The use of ‘licensed band’ is typically limited to 133 and the only exception of usage in 101 or 104 is for V2X. Therefore, our preference would be to stick to Alt 3, which is aligned with existing specification.With this said, if companies still prefer Alt. 1 or Alt. 2, we can accept Alt 1. or Alt. 2. |
| Nokia, Nokia Shanghai Bell |  We are ok with alt 2. |
| OPPO | Ok with Alt 2 with small changes below, since based on 1st round feedback it seems this “subject to…” is trying to inform there might be different regulation requirements in different regions/countries rather than means whether this band is unlicensed band subject to regional regulation. By adding “regulation requirements” it is clear this is about the requirements.* Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulation requirements.
 |
| Huawei | Ok with Alt. 2  |

Issue 2-2b: NR CA bandwidth class

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

Issue 2-2c: Channel spacing for CA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | We agree with moderator’s suggestion |
| Apple | The candidate option seems OK. |
| Intel | As proponents of the option, we are ok with suggested formulation. |
| Nokia, Nokia Shanghai Bell | The formula itself if fine, but we suggest to remove the last brackets in final version, i.e. to write 50.4 instead of (100.8/2). |
| Huawei | Ok with the recommendation. Agree with Nokia above. |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2214430 |  |
| R4-2214480 |  |

## Summary for 2nd round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#2-1: Unlicensed FR2 band** | **Issue 2-1: Note on unlicensed operation***Tentative agreement:**NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulation requirements* |
| **Sub-topic#2-2: Operating bands and channel arrangement for CA** | **Issue 2-2c: Channel spacing for CA***Tentative agreement:**Channel spacing for adjacent NR carriers in FR2-2*Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8 MHz) \* 50.4 MHz*Channel spacing for CA in FR2-2*Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8 MHz) \* 50.4 MHz |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2214430 | *Agreeable* |
| R4-2214480 | *Agreeable* |

# Topic #3: FR1+FR2-2 DC/CA band combinations

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2212118**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212118.zip)UE feature list and general aspects for NR ext. to 71GHz | Intel Corporation | *UE feature for NR ext. to 71GHz***Proposal 1:** Adopt the improved ON/ON transient period feature listed in Table 1 for NR\_ext\_to\_71GHz*Concluding NR ext. to 71GHz***Observation 1:** RAN4 should aim to reach consensus or tentative agreements for the remaining single-carrier requirements. Confirming tentative agreements and minor revisions can be handled in the maintenance stage.**Observation 2:** Alignment is needed to decide on the best approach to take to ensure a band combination for the case of FR2-2 DC/CA with an anchor in FR1 is defined. A potential option is detailed below:* RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
* Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
* To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase
 |

## Open issues summary

### Sub-topic 3-1: Defining a band combination for FR1 + FR2-2 DC/CA

*At least one band combination for the case of FR2-2 DC/CA with an anchor in FR1 needs to be included to complete the work item. Alignment on an approach to take is encouraged.*

**Issue 3-1: Approach to introduce an FR2-2 DC/CA with an anchor in FR1 combination**

* Option (Intel, R4-2212118)
	+ RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
	+ Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
	+ To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase
* Recommended WF
	+ Please share your views on the suggested approach, and any modifications or recommendations to introduce band combinations
	+ Based on operator interest, companies are asked to consider n48 + n263 as a potential FR2-2 DC/CA + FR1 band combination to be completed within this work item

## Companies views’ collection for 1st round

### Open issues

Issue 3-1: Approach to introduce FR2-2 DC/CA with an anchor in FR1 band combinations

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Comm Inc | We support the moderators comment, “companies are asked to consider n48 + n263 as a potential FR2-2 DC/CA + FR1 band combination to be completed within this work item” |
| Ericsson | We agree with the option listed |
| Huawei | It seems to be the only workable solution to finalize FR1 + FR2-2 DC/CA within the extended WI.  |
| Intel | As proponents, we agree with the presented option and support considering n48 + n263 as a potential FR2-2 DC/CA + FR1 band combination to be completed within this work item |
| CHTTL | In our understanding, normally with one example band combination and few configurations, the WI can be completed. |

### CRs/TPs comments collection

*N/A*

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #3-1: Defining a band combination for FR1 + FR2-2 DC/CA** | **Issue 3-1: Approach to introduce FR2-2 DC/CA with an anchor in FR1 band combinations** *Agreements reached in GTW session – Aug. 18th:***Agreement:** * Specify n48 + n263 within this work item and if n48 + n263 is completed, then the WI is viewed as completed.

**Agreement:*** + RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
	+ Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
	+ To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase
 |

### CRs/TPs

*Recommendation for a new CR to introduce FR1+FR2-2 DC/CA band combination is captured in* [***Section 4.1***](#_1st_round)

## Discussion on 2nd round

*Please share your feedback for draft CR R4-2214431 (*[***Draft CRs***](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B110%5D%20NR_ext_to_71GHz_Part_1/Round2/Draft%20CRs)*)*

## Companies views’ collection for 2nd round

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2214431 | Charter Communications Inc. We have uploaded Draft R4-2214431 Draft CR for TS 38.101-3 to add new NR\_CADC 2BDL\_xBUL combinations containing FR1 + FR2-2 for approval |
| Nokia: It seems the draft CR is not made on top of latest specification and it includes configurations for n263 which are not part of the CR to 38.101-2. These need to be corrected in final version to enable implementation of the CR. |
| Charter Communications Inc, : Nokia: A revision 3 will be uploaded soon to reflect the correct changes and also based on 38.101-3 version 17.6Charter Communications Inc. Revision 6 has been uploaded. Formatting errors have been corrected, multiple carrier uplink on n263 was deleted to match draft cr 38.101-1 configuration and revision clauses were edited to include all changes. |

## Summary for 2nd round

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2214431 | *Agreeable* |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
| R4-2214422 | WF on system parameters for FR2-2 | Intel Corporation |  |
| R4-2214430 | Draft CR for TS 38.101-2 on system parameter updates for FR2-2 | Nokia, Nokia Shanghai Bell | CR to capture latest system parameter agreements |
| R4-2214480 | Draft CR for TS 38.104 on system parameter updates for FR2-2 | Nokia, Nokia Shanghai Bell | CR to capture latest system parameter agreements |
| R4-2214431 | Draft CR for TS 38.101-3 to add new NR\_CADC 2BDL\_xBUL combinations containing FR1 + FR2-2 | Charter Comm Inc. | CR to introduce FR1+FR2-2 DC/CA band combination |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2211697 |  | Reply LS for the minimum guard period between two SRS resources for antenna switching | CATT | Revised |  |
| R4-2211873 |  | Remaining issues on system parameters for NR operation in 52.6GHz - 71GHz | Apple Inc. | Noted |  |
| R4-2212118 |  | UE feature list and general aspects for NR ext. to 71GHz | Intel Corporation | Noted |  |
| R4-2212845 |  | Contiguous DL CA system parameters for FR2-2 | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2213231 |  | SSB side conditions for band n263 | Apple Inc. | Noted |  |
| R4-2213370 |  | Draft reply LS on the minimum guard period between two SRS resources for antenna switching | Huawei, HiSilicon | Noted |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2214422 |  | WF on system parameters for FR2-2 | Intel Corporation | Return to |  |
| R4-2214430 |  | Draft CR for TS 38.101-2 on system parameter updates for FR2-2 | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2214480 |  | Draft CR for TS 38.104 on system parameter updates for FR2-2 | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2214431 |  | Draft CR for TS 38.101-3 to add new NR\_CADC 2BDL\_xBUL combinations containing FR1 + FR2-2 | Charter Comm Inc. | Agreeable |  |
| R4-2211697 |  | Reply LS for the minimum guard period between two SRS resources for antenna switching | CATT | Return to |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents