**3GPP TSG-RAN WG4 Meeting # 98-e R4-2103293**

**Electronic Meeting, January 25th – February 5th, 2021**

**Agenda item:** 4.2.2

**Source:** Moderator (Apple)

**Title:** Email discussion summary for [98e][103] NR\_NewRAT\_UE\_RF\_Part\_2

**Document for:** Information

# Introduction

This document summarizes the email discussions for agenda item 4.2.2. The agenda item 4.2.2 is intended for FR2 UE RF requirements maintenance. Most of contributions in this agenda item are CRs where some of them are associated with a discussion paper to justify the CR contents. R4-2101722 which was originally submitted to agenda item 7.19.3 (email thread [113]) will be treated in this email thread.

The discussions of this email thread are divided into the following five topics, EESS protection requirements after WRC-19, NR SCC UL power drop behavior in FR2, beam correspondence requirement for all power classes, FR2 UE minimum output power requirement, and other CRs for 38.101-2.

# Topic #1: EESS protection requirements after WRC-19

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2100109**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100109.zip)Type: OtherFor: Approval | Nokia, Nokia Shanghai Bell | **Title:** On NS\_203/CA\_NS\_203 for n258**Proposal 1:** Mandatory support of modifiedMPR-Behaviour as well as NS\_203/CA\_NS\_203 for n258 shall be clarified in TS38.101-2.**Proposal 2:** The following note shall be included in relevant tables such as Table 6.2.3.1-1, Table 6.2.3.1-2, Table 6.2A.3.1-1 and Table 6.2A.3.1-2**NOTE:** A UE supporting n258 shall support NS\_203 (CA\_NS\_203 for CA NS tables) by means of modifiedMPR-Behaviour specified in Annex H.1.**Proposal 3:** Remove “15.11.0” for a row of NS\_203 for n258 from Annex H.1 and add a text to allow UEs referring to an older version to implement NS\_203/CA\_NS\_203. |
| [**R4-2100085**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100085.zip)Type: CRFor: AgreementCAT: FRel-15 | Nokia, Nokia Shanghai Bell | **Title:** Clarification on NS\_203 support by n258**Reason for change:** A way to mandatory support of NS\_203/CA\_NS\_203 by n258 is not clear.**Summary of change:**Add NOTEs to Tables related to NS\_203/CA\_NS\_203 to clarify that these NSs are mandatory support by n258 by means of modifiedMPR-Behaviour.Remove spec version of 15.11.0 for a row of NS\_203 for n258 from Annex H.1. and add a text to allow UEs referring to older versions to implement NS\_203/CA\_NS\_203 by n258.Make a section relevant to CA\_NS\_201 “void”. |
| R4-2100086Type: CRFor: AgreementCAT: ARel-16 | Nokia, Nokia Shanghai Bell | **Title:** Clarification on NS\_203 support by n258**Note**: This is the mirror CR of R4-2100085. |
| R4-2100087Type: CRFor: AgreementCAT: ARel-17 | Nokia, Nokia Shanghai Bell | **Title:** Clarification on NS\_203 support by n258**Note**: This is the mirror CR of R4-2100085. |
| [**R4-2101201**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101201.zip)Type: OtherFor: Approval | NTT DOCOMO, INC. | **Title:** Further discussion on EESS protection**Observation 1:** EESS protection requirements for n257 was specified in Japanese regulation.**Proposal 1:** Focus on options 2/3/4/5. **•** Before agreeing option 2, an appropriate length of the period to make chipset, UE, NW, and TE compatible with new NS(s) should be investigated.• If the appropriate length of the period cannot be determined, take option 3/4/5 focusing how to write a relevant NOTE. |
| [**R4-2101523**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101523.zip)Type: OtherFor: Approval | OPPO | **Title:** Discussion on WRC-19 remaining issues**Observation 1**: Introducing now or in the future is the main difference for 2024/2027 requirements.**Observation 2**: Introduction of NS\_203 has set a good example on how to introduce requirement for the near future.**Observation 3**: Possibility of forgetting these 2024/2027 requirements in RAN4 is low.**Observation 4**: Without being required by regulatory bodies, the meaning of introducing future requirements is low.**Observation 5**: Comparing introducing now, postpone defining the 2024/2027 requirements will have less impact to RAN4/RAN5/GCF and also the industry.**Proposal 1**: Postpone defining the 2024/2027 requirements, NS\_203 approach can be used as reference in future. |

## Open issues summary

**Issue 1.2-1: How to handle EESS protection requirements with changeover dates in 2024/2027?**

### Option 1: Postpone defining the requirements till close to changeover dates. NS\_203 approach can be used as reference in future.

### Option 2: Introduce all foreseen NS into standard now and use normative or informative notes like ‘applicable from <calendar date>’ to indicate the changeover dates.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
|  | Issue 1.2-1: |
| OPPO | Option 1 can be used for future requirements like NS\_203 approach. Regarding option 2 the problem might be once there is regions require these requirements before the <calendar date> then it would cause problem in RAN4 and RAN5 to update the specs. |
| Ericsson | Important is that the NS values are specified in appropriate regional/national standards such that UE can be tested for regulatory compliance after the changeover date. This means that the NS values should be specified in 3GPP in due time such that requirements can be transcribed to harmonised standards that can be published before the changeover date. Dates in 3GPP standards have no meaning other than informative. Option 1: see above.Option 2: this also possible. Then UEs have to meet the requirements for all NS value for a supported band from the release in which these values are specified (e.g. Rel-17). This would leave time for implementation in regulatory document and “legacy” UEs would meet the new requirement when the network signals the NS after the changeover date. |
| Apple | Option 1 |
| Qualcomm | Option 2.The allowance for legacy UEs in this context gets very cryptic in the standard without including dates in some form |
| ZTE | Option 1 |
| Nokia | Maybe the option 1 includes some ambiguity like “close”. And this looks precluding discussing the necessity of new NSs if the discussion is really necessary before the dates “close” to changeover dates.We are taking time to discuss procedure in the future but at least no one is proposing urgency of introducing new NSs now.Thus, our alternative is not using “postpone” but rather we say that RAN4 again discusses new NSs whenever the necessity is identified. |
| Samsung | We believe Option 1 is more clear way forward than noting the future change which will be nothing for the time being. It is also a better option to avoid any misunderstanding for RAN5 or other groups since NS is adapted for UE specs. The timing issue can be applied to Option 2 as well as Option 1. RAN4 can further discuss about it. In that sense, we are also find with Nokia’s alternative. |
| Xiaomi | Option 1. NS\_203 can be an example of the WRC-19 requirement implementation. |
| Huawei | It is not necessary to define EESS protection requirements with changeover dates in 2024/2027, NS\_203 is always allowed. |
| NTT DOCOMO, INC. | Thank you very much for feedbacks.Option 2 is our preference. Regarding option 1, as Nokia mentioned, some modification is needed in order not to precluding discussion before the changeover date. In addition, clarification on “same approach” is also needed such as using modified MPR, introducing new NS from Rel-15, making it mandatory after the version of spec where new NS(s) is introduced and so on. To OPPOWe understood the problem of option 2. If a regulatory require the requirements before the already defined calendar date, then the date is needed to be updated. Note that, for at least n257 in Japan, the regulatory already defined September, 2027 as the changeover date. To Samsung“The timing issue can be applied to Option 2 as well as Option 1.” Yes, even if we take option 2, we need to take care about when we should start getting ready toward changeover date.The difference is that if we take option 2, TS 38.101-2 specifying the related requirements will be published in advance. So the required process after RAN4 working can be moving forward based on the decision of each organization and company. |

### Comment collection for discussion papers

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| **Tdoc number** | **Comments** |
| [**R4-2100109**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100109.zip) | **Title**: On NS\_203/CA\_NS\_203 for n258**Comments**:[OPPO] For clarification, is there NS\_203 defined before 38.101-2 v15.11.0 if v15.11.0 is removed from “NS\_203 as defined in clause 6.5.3.2.4 or both NS\_203 and CA\_NS\_203 as defined in clause 6.5A.3.2.4 of 38.101-2 v15.11.0”? Not quite understand the meaning.Ericsson: We agree with the statement that requirements for all NS for a supported band must be met. The bit for NS\_203 is not needed if the UE must meet the additional requirements. The requirement is mandated for UEs released after the changeover date (01/21), UEs put on the market after 01/21 must comply. If there are 'early' UEs released before 01/21 compliant with NS\_201 these would not set the bit. Proposal 1: is the modifiedMPRbehavior needed? This would only be the case if there are devices put on the market before the changeover date and implemented according to an earlier Rel-15 version. The network is not aware of the UE version but will set NS\_203 after 01/21. Nokia: To OPPO, NS\_203 was introduced from v15.11.0. NS\_203 is not removed, but rather “v15.11.0” captured in the spec is removed. See the CR.To Ericsson, the bit in modifiedMPRbehaviour for NS\_203 was introduced assuming that there have been UEs supporting n258 without supporting NS\_203 and to distinguish these UEs and UEs to support NS\_203. |
| [**R4-2101201**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101201.zip) | **Title:** Further discussion on EESS protection**Comments:**[OPPO] We understand the concern of introducing the WRC-19 requirements only at the time of 2024/2027 due to some period is required for RAN5/GCF preparation, that’s why we suggest to follow introducing NS\_203 approach, i.e. sometime before the 2024/2027.Ericsson: see comments to issue 1.2-1.Qualcomm: good analysis. We agree with this aspect of proposal 1:If the appropriate length of the period cannot be determined, take option 3/4/5 focusing how to write a relevant NOTE. |
| [**R4-2101523**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101523.zip) | **Title:** Discussion on WRC-19 remaining issues**Comments:**[OPPO] Our view is that the practice of introducing NS\_203 actually is a good example for future requirement introduction which can be used for the 2024/2027 requirements.Qualcomm: Observation 4 (‘Without being required by regulatory bodies ….’) was used to build the proposal to postpone treatment, but regulators have indeed started adopting WRC19 resolutions as regulations. The implication is that the proposal (‘Postpone defining the 2024/2027 requirements …’) does not apply for this situation. |

### CRs/TPs/LSs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| [**R4-2100085**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100085.zip) | **Title:** Clarification on NS\_203 support by n258 |
| [OPPO] Whether the v15.11.0 can be removed depends on the discussion in R4-2100109Ericsson: the use of modifiedMPR behavior is unclear, see also comments to 1.2-1. Handling of early UEs: if a new NS (e.g. NS\_203) is introduced late in a release then UEs implemented according to an earlier version may (or will not) set the bit; UEs of later releases shall set the bit. If there are early Rel-15 UEs supporting n258 (and thus NS\_201) released on the market before the changeover date 01/21, these would not set the bit. The notes should indicate that support of requirements for NS\_203 is subject to modifiedMPRbehaviour, not that NS\_203 shall be supported. Is the bit for NS\_203 needed at all?Qualcomm: The change is ok, but it may be better to think about alternative ways to describe the exemption for legacy UEs. The allowance for legacy UEs in this context gets very cryptic in the standard without including dates in some form.Nokia: To Qualcomm, do you have any texts for the exemption in mind?Huawei: modified MPR approach in NS\_203 supporting should be removed totally, and we can add a note to say: NS\_203 is mandatory to support if UE support Band n258. With modified MPR, old UEs may indicate 0 on this bit, but the new gNBs will not configure measurement for these UEs, thus no handover command to such old UEs. These in market UEs cannot handover to proper cells which actually should not be required to support NS\_203. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Issue 1.2-1** | **How to handle EESS protection requirements with changeover dates in 2024/2027?**Option 1: Postpone defining the requirements till close to changeover dates. NS\_203 approach can be used as reference in future. (OPPO, Ericsson, Apple, ZTE, Nokia, Samsung, Xiaomi)Option 2: Introduce all foreseen NS into standard now and use normative or informative notes like ‘applicable from <calendar date>’ to indicate the changeover dates. (Ericsson, Qualcomm, NTT DOCOMO)**Status**: No agreement, but more companies supporting Option 1 |
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*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2100085**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100085.zip) | To be revised |
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### Discussion papers

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| **Tdoc number** | **Status update recommendation**  |
| [**R4-2100109**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100109.zip) | Noted. It is suggested to focus on the agreement of the associated CR in 2nd round. |
| [**R4-2101201**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101201.zip) | Noted |
| [**R4-2101523**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101523.zip) | Noted |

## Discussion on 2nd round (if applicable)

The following CR is returned to 2nd round to see if agreement can be reached with further clarifications or revisions.

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| R4-2103125 | **Title:** Removal of a remaining NS\_201 related requirement |
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|  | **Title:**  |
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## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
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# Topic #2: NR SCC UL power drop behavior in FR2

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2101738**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101738.zip)Type: Discussion and LS outFor: Approval | OPPO | **Title:** Discussion on FR2 equal PSD in CA and draft LS**Observation 1:** Equal PSD restriction was introduced into spec without much explanation why this is needed for Pcmax.**Observation 2:** No such equal PSD restriction for Pcmax exists in other RAN4 specs like 36.101, 38.101-1 and 38.101-3.**Proposal 1:** It is proposed to remove the equal PSD restriction from Pcmax section.**Observation 3:** Usually MPR are derived based on some precondition (the worst case), however, it applies to all the scenarios and there is no need to mention about the precondition in spec.**Observation 4:** No such equal PSD restriction for MPR exists in other RAN4 specs like 36.101, 38.101-1 and 38.101-3.**Proposal 2:** It is proposed to not specify the equal PSD restriction in MPR section.**Proposal 3:** It is proposed to inform RAN5 about the updates and backgrounds in RAN4 specs to facilitate test case design. |
| [**R4-2101739**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101739.zip)Type: CRFor: AgreementCAT: FRel-15 | OPPO | **Title:** CR on FR2 equal PSD in UL CA**Reason for change:**As discussed in R4-2101738, the equal PSD restriction in Pcmax is not needed and it has caused confusions in interpretation of requirements.**Summary of change:**Remove the equal PSD restriction from CA Pcmax. |
| R4-2101740Type: CRFor: AgreementCAT: ARel-16 | OPPO | **Title:** CR on FR2 equal PSD in UL CA (R16 mirror CR)**Note**: The is the mirror CR of R4-2101739. |
| R4-2101741Type: CRFor: AgreementCAT: ARel-17 | OPPO | **Title:** CR on FR2 equal PSD in UL CA (R17 mirror CR)**Note**: The is the mirror CR of R4-2101739. |
| [**R4-2101722**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101722.zip)Type: Discussion and LS outFor: Approval | Ericsson | **Title:** LS to RAN5 on SCell dropping behavior and verification thereof**Proposal 1:** verification should be based on “Option 2: Measure the UE as is even SCC output may be scaled down under CA mode” relevant for UE operations in the field. This should be liaised with RAN5.Another issue is testability:**Observation 1:** The problem of verifying maximum output power with SCell power reduction is exacerbated by the allowed MPR values and the large tolerances for the configured maximum output power.**Observation 2:** given anticipated TE measurement performance, verification of the maximum output power for UL CA appears viable only for BPSK and QPSK using the TRP metric**Observation 3:** for CABW ≤ 400 MHz, the output power requirement for aggregated CCs of the same order the case of a single CC, of about 2 dB smaller for the non-CA except for DFT-s-OFDM pi/2-BPSK and QPSK, whereas for CABW > 400 MHz there is a larger difference. Hence dropping the SCells would only slightly change the PASS/FAIL limits should the remaining PCell be subject to non-CA requirements.and we make the following**Proposal 2:** for a UE significantly reducing (by at least [6] dB) the total SCell power or dropping the SCell(s) at maximum output power, the requirements for the total output power should be in accordance with that for a single carrier (in non-CA operation) of the same bandwidth as the PCell.Another remedy for Rel-17 could be **Proposal 3:** to prevent SCell dropping or a large power reduction, consider for Rel-17 UE-specific absolute and/or relative power limits (P-Max) modifying the configured maximum output power per serving cell for specific transmissions.**Proposal 4:** the absolute/relative power limits are set up during the RRC reconfiguration (or modification) of the band combination. The limit to be used by the UE could be determined by a MAC-CE or a PDCCH message based on a DCI format, allowing fast adaptation to changing radio conditions by temporarily enabling/disabling limits. |

## Open issues summary

**Issue 2.2-1: Is it agreeable to remove equal PSD restriction from Pcmax section?**

### Option 1: Yes

### Option 2: No

**Issue 2.2-2: Is it agreeable to not specify the equal PSD restriction in MPR section?**

### Option 1: Yes

### Option 2: No

**Issue 2.2-3: Which of the following options should be used by RAN5 for verification of the intra-band UL CA test cases?**

### Option 1: Equal PSD between CCs

### Option 2: Measure the UE as is even SCC output may be scaled down under CA mode

**Issue 2.2-4: Is it agreeable that for a UE significantly reducing (by at least [6] dB) the total SCell power or dropping the SCell(s) at maximum output power, the requirements for the total output power should be in accordance with that for a single carrier (in non-CA operation) of the same bandwidth as the PCell?**

### Option 1: Yes

### Option 2: No

**Issue 2.2-5: Is it necessary to modify UL CA PCMAX definition in Rel-17 to prevent dropping of SCell transmissions?**

### Option 1: Yes

### Option 2: No

**Issue 2.2-6: Is it agreeable to inform RAN5 about the updates and backgrounds in RAN4 specs to facilitate test case design?**

### Option 1: Yes

### Option 2: No

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
|  | Issue 2.2-1:Issue 2.2-2:…. |
| OPPO | **Issue 2.2-1: Is it agreeable to remove equal PSD restriction from Pcmax section?** No strong view. Regarding the equal PSD restriction itself, if this restriction is required the meaning of this restriction should be clear to RAN4 and RAN5 like what will happen if the actual PSD between CCs are different and whether Pumax needs to be tested under equal PSD scenario, etc.**Issue 2.2-2: Is it agreeable to not specify the equal PSD restriction in MPR section?**Option 2, no**Issue 2.2-3: Which of the following options should be used by RAN5 for verification of the intra-band UL CA test cases?**Considering this is RF testing, then the Option 1 equal PSD between CCs can be used as the test condition by some RAN5 based approach like the testing commands, etc.**Issue 2.2-4: Is it agreeable that for a UE significantly reducing (by at least [6] dB) the total SCell power or dropping the SCell(s) at maximum output power, the requirements for the total output power should be in accordance with that for a single carrier (in non-CA operation) of the same bandwidth as the PCell?****Issue 2.2-5: Is it necessary to modify UL CA PCMAX definition in Rel-17 to prevent dropping of SCell transmissions?****Issue 2.2-6: Is it agreeable to inform RAN5 about the updates and backgrounds in RAN4 specs to facilitate test case design?**Regarding the Issue 2.2-4 to Issue 2.2-6, no strong view, but in our understanding this test can be done in equal PSD condition by RAN5 based testing methods. |
| Ericsson | **Issue 2.2-1: Is it agreeable to remove equal PSD restriction from Pcmax section?**Option 2: no, not if the statement specifies how the Pcmax (total power) shall be calculated. It follows from “The definition of the configured UE maximum output power PCMAX,*f,c* for each carrier *f* of a serving cell *c* is used for power headroom reporting for carrier *f* of serving cell *c* only and is in accordance with that specified in clause 6.2.4 with parameters MPR, A-MPR and P-MPR replaced with those specified in clause 6.2A.2, 6.2A.3 and 6.2.4, respectively.”that the MPR on each serving cell *c* replaced with the value for CA, the same for all cells. The “PCMAX is calculated under the assumption that power spectral density for each RB in each component carrier is the same.” could possibly mean that Pcmax,f,c = Pcmax for intra-band CA also in FR2. Then the SCells are dropped once the PCell attains maximum power, see also comments to 2.2-5.**Issue 2.2-2: Is it agreeable to not specify the equal PSD restriction in MPR section?**No strong view. This has been the prerequisite for intra-band CA since early releases. It was also used for deriving the A-MPR for the total power for intra-band contiguous EN-DC combinations in FR1.**Issue 2.2-3: Which of the following options should be used by RAN5 for verification of the intra-band UL CA test cases?**Option 2: the MOP for CA must be tested in accordance with behavior in the field, it’s not verification of RAN4 MPR estimation.**Issue 2.2-4: Is it agreeable that for a UE significantly reducing (by at least [6] dB) the total SCell power or dropping the SCell(s) at maximum output power, the requirements for the total output power should be in accordance with that for a single carrier (in non-CA operation) of the same bandwidth as the PCell?**Option 1: yes. This would be one way to increase the power of the remaining PCell in the case that the SCell power is reduced due to power prioritization.We remark that the large tolerances imply very low UE PASS/FAIL limits, from R4-2101722,Example 1: equal CC PSD, 4 x 100 MHz at 28 GHz for PC3. The lowest back-off is for QPSK, MPR = 5 dB (Table 6.2A.2.4-1 in 38.101-2). This means that the PASS/FAIL limit would be around (to within dBs)23 dBm [power class] – 5 dB [MPR] – T(5) [Pcmax tolerance at 5 dB] – 3 dB [TT] = 11 dBm (per 4 x 100 MHz) total power assuming a TT = 3 dB also for CA -- if SCells are not dropped. The PASS/FAIL limit would be increased to 16.5 dBm should the UE apply the MPR for the remaining 100 MHz PCell (edge allocations). This would also be sufficient for meeting requirements with the SCell power significantly reduced.**Issue 2.2-5: Is it necessary to modify UL CA PCMAX definition in Rel-17 to prevent dropping of SCell transmissions?**Option 1: yes. This is one way of reserving power for PCell and SCell transmissions of a certain type (e.g. PUSCH) and resemble the power prioritization for LTE for which PUSCH power is split between serving cells once higher priorities have been allocated power.We remark that SCell dropping is a problem in the field, also for FR1, not only in testing. If this requires RAN1 changes, so be it.**Issue 2.2-6: Is it agreeable to inform RAN5 about the updates and backgrounds in RAN4 specs to facilitate test case design?**Yes, RAN4 should inform RAN5 that UEs should be tested in accordance with their behavior in the field (Option 2 in 2.2-3), no test modes that disable functionality. |
| Sony | **Issue 2.2-1: Is it agreeable to remove equal PSD restriction from Pcmax section?** We understand the intention of removing it to stop causing further confusion. However, we think the sentence itself provides the background information on how Pcmax is calculated. Therefore, considering to re-word/clarify the sentence might be a better option. **Issue 2.2-3: Which of the following options should be used by RAN5 for verification of the intra-band UL CA test cases?**Option 2: Measure the UE as is even SCC output may be scaled down under CA mode**Issue 2.2-4: Is it agreeable that for a UE significantly reducing (by at least [6] dB) the total SCell power or dropping the SCell(s) at maximum output power, the requirements for the total output power should be in accordance with that for a single carrier (in non-CA operation) of the same bandwidth as the PCell?**At least when the UE drops the Scell, single CC requirements could be applied. It is our understanding that the UE behaves the same as single CC operation in this case.**Issue 2.2-6: Is it agreeable to inform RAN5 about the updates and backgrounds in RAN4 specs to facilitate test case design?** Option 1: Yes |
| Apple | Thanks to OPPO’s and Ericsson’s continual efforts on trying to resolve this potential issue in testing raised by RAN5. Before we share our views in the corresponding issues above, we would like to understand why this potential issue was only raised for FR2 intra-band UL CA. Shouldn’t this issue also exist in LTE and NR FR1 if UE indeed prioritized PCC over SCC according to RAN1 specifications? However, so far we have not heard the issue being raised for LTE or FR1 intra-band UL CA MOP tests. So we wonder if this SCC power reduction or dropping is a correct behavior for UE. It is understandable that PCC shall be prioritized over SCC if UE’s PHR becomes insufficient during CA operation. But we wonder if the SCC power reduction or dropping can be determined by UE itself or should be managed by the network. Our understanding is that it should be managed by the network since the TPC commands and the activation/deactivation of the SCC are determined by the network.In our view, for intra-band UL CA, equal PSD between PCC and SCC should be the nominal setting for UE as PCell and SCell are expected to be collocated and synchronized. It is meant to maintain the same SNR for both CCs when they arrive at the base station. Intra-band contiguous CA should be viewed as an extension of single CC bandwidth except with an intra-carrier guard band. Despite the power control loop can be independent between PCC and SCC, from UE implementation point of view, a significant portion of the UL power control is in the analog domain which is shared by PCC and SCC, especially under intra-band contiguous UL CA operation. And the independent power control can only be done in digital baseband. Therefore, before we draw any conclusion in RAN4, we suggest to have UE vendors to clarify whether this SCC power reduction or dropping is a reasonable behavior and why this behavior was not seen in LTE or FR1.  |
| Qualcomm | Issue 2.2-1: Option 2. We would rather leave the sentence there since it defines the condition for initial Pcmax calculation before power control calculation and scaling Issue 2.2-2: With the question wording, we prefer option 2. We agree not to specify it but we can add a informative note about the conditions. This is technically not “specifying” anything. And it should be clear that the MPR is valid for all conditions since MPR is UE maximum power reduction and not per cell power reduction. Issue 2.2-3: How ran5 verifies should be left to ran5 so we should not make too strong statements about it in ran4 but we agree that the verification under equal PSD condition would make sense given the test procedure problem with the scaling. Issue 2.2-4: This Ericsson proposal would be non-backwards compatible change for a Rel-15 UE behavior and therefore just because of that aspect we choose option 2 and can not agree with the change. Also, it seems very complicated and forces UE to recalculate the power after scaling which is against the RAN1 power control procedure. It seems that Ericsson erroneously assumes UE can do the recalculation of the output power after the scaling.Issue 2.2-5: We can discuss Rel-17 changes since the release is work under progress but the paper seems to suggest Rel-16 changes and agenda is Rel-15 In all cases we would then need to distinguish rel-15 behavior from this new behavior so either change needs to go back to Rel-15 or then a new capability needs to be added. But this change is our view is against ran1 behavior since UE is not able to recalculate pcmax after the scaling. So we can not accept anything else than option 2.Issue 2.2-6: Option 1 but we can not accept any of the proposed wordings. Our view is that RAN4 should inform RAN5 about two things1. RAN5 should work on test procedures as they see fit

Ran4 MPR work was done under the assumption that the power per RB is same for all cells i.e. PSD was assumed equal.  |
| ZTE | Issue 2.2-1: Option 2.Issue 2.2-3: share same with with QC. At least in RAN4, equal PSD makes sense. |
| Huawei | Issue 2.2-1: this sentence need a slight revision-> Pcmax,f,c is calculated under the assumption that PSD for each RB …..This is the power control calculation for each CC, not for CA Pcmax, so RAN4 does not mandate UE to transmit with equal PSD. It means, when power of each CC are summed up, scell drop maybe happened because the total power is exceeded.It is very clear power control procedure for both FR1 and FR2, there is no difference.Issue 2.2-3: This can be left to RAN5.Issue 2.2-5: this is RAN1 work scope on CC priority.  |
| T-Mobile USA | Issue 2.2-1: Option 2. We agree with Ericsson. Issue 2.2-2: No preference.Issue 2.2-3: Option 2: the MOP for CA must be tested in accordance with behavior in the field, it’s not verification of RAN4 MPR estimation.Issue 2.2-4: Option 1: yes. Issue 2.2-5: Option 1: yes. Issue 2.2-6: Yes |
| NTT DOCOMO, INC. | **Issue 2.2-3: Which of the following options should be used by RAN5 for verification of the intra-band UL CA test cases?**We think option 1 is one of the candidate of power setting.For option 2, even if SCC output power is scaled down due to prioritization, we should test UE transmitting power across all CCs in CA mode. Reduced power level should be limited by a certain level, e.g., [3]dB.**Issue 2.2-4: Is it agreeable that for a UE significantly reducing (by at least [6] dB) the total SCell power or dropping the SCell(s) at maximum output power, the requirements for the total output power should be in accordance with that for a single carrier (in non-CA operation) of the same bandwidth as the PCell?**No, even if SCC output power is scaled down due to prioritization, we should test UE transmitting power across all CCs in CA mode. Reduced power level should be limited by a certain level, e.g., [3]dB.**Issue 2.2-6: Is it agreeable to inform RAN5 about the updates and backgrounds in RAN4 specs to facilitate test case design?**Yes, as far as we understand, RAN5 seems to need some feedback from RAN4.  |

### Comment collection for discussion papers

|  |  |
| --- | --- |
| **Tdoc number** | **Comments** |
| [**R4-2101738**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101738.zip) | **Title:** Discussion on FR2 equal PSD in CA and draft LS**Comments**:[OPPO] Wait for the outcome of the above discussions.Ericsson: not agreed.Apple: Subject to further clarification on UE behavior and the comparison to FR1. |
| [**R4-2101722**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101722.zip) | **Title:** LS to RAN5 on SCell dropping behavior and verification thereof**Comments**:[OPPO] Wait for the outcome of the above discussions.Apple: Subject to further clarification on UE behavior and the comparison to FR1. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2101739**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101739.zip) | **Title:** CR on FR2 equal PSD in UL CA |
| [OPPO] Wait for the outcome of the above discussions.Ericsson: not agreed if the statement specifies how the Pcmax (total power) shall be calculated, otherwise agreeable.Apple: Subject to further clarification on UE behavior and the comparison to FR1. Huawei: this sentence need a slight revision-> Pcmax,f,c is calculated under the assumption that PSD for each RB ….. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Issue 2.2-1** | **Is it agreeable to remove equal PSD restriction from Pcmax section?**Option 1: Yes Option 2: No (Ericsson, Apple, Qualcomm, ZTE, T-Mobile USA)**Status**: Option 2 is agreed. |
| **Issue 2.2-2** | **Issue 2.2-2: Is it agreeable to not specify the equal PSD restriction in MPR section?**Option 1: YesOption 2: No (OPPO, Apple, Qualcomm)**Status**: Option 2 is agreed. |
| **Issue 2.2-3** | **Which of the following options should be used by RAN5 for verification of the intra-band UL CA test cases?**Option 1: Equal PSD between CCs (OPPO, Apple, Qualcomm, ZTE, NTT DOCOMO)Option 2: Measure the UE as is even SCC output may be scaled down under CA mode (Ericsson, Sony, T-Mobile USA)Option 3: Left to RAN5 (Apple, Qualcomm, ZTE, Huawei)**Status**: No agreement |
| **Issue 2.2-4** | **Is it agreeable that for a UE significantly reducing (by at least [6] dB) the total SCell power or dropping the SCell(s) at maximum output power, the requirements for the total output power should be in accordance with that for a single carrier (in non-CA operation) of the same bandwidth as the PCell?**Option 1: Yes (Ericsson, Sony, T-Mobile USA)Option 2: No (Qualcomm, NTT DOCOMO) **Status**: No agreement |
| **Issue 2.2-5** | **Is it necessary to modify UL CA PCMAX definition in Rel-17 to prevent dropping of SCell transmissions?**Option 1: Yes (Ericsson, T-Mobile USA)Option 2: No (Qualcomm)**Status**: No agreement |
| **Issue 2.2-6** | **Is it agreeable to inform RAN5 about the updates and backgrounds in RAN4 specs to facilitate test case design?**Option 1: Yes (Ericsson, Sony, Qualcomm, T-Mobile USA, NTT DOCOMO)Option 2: No**Status**: Option 1 is agreed. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | LS on SCell dropping | OPPO |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2101739**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101739.zip) | NotedModerator’s note: It is unlikely this CR can be agreed in this meeting. |
| R4-2101740 | Withdrawn (Rel-16 mirror CR of R4-2101739) |
| R4-2101741 | Withdrawn (Rel-17 mirror CR of R4-2101739) |

### Discussion papers

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| --- | --- |
| **Tdoc number** | **Status update recommendation**  |
| [**R4-2101738**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101738.zip) | Noted. It is suggested to focus on the approval of the associated LS to RAN5 in 2nd round. |
| [**R4-2101722**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101722.zip) | Noted |

## Discussion on 2nd round (if applicable)

|  |  |
| --- | --- |
| R4-2103124 | **Title:** LS on SCell dropping |
|  |
|  | **Title:**  |
|  |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| --- | --- |
| **CR/TP/WF number** | **CRs/TPs/WFs Status update recommendation**  |
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# Topic #3: Beam correspondence requirement for all power classes

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2102663**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102663.zip)Type: DiscussionFor: Approval | Qualcomm Finland RFFE Oy | **Title:** Completion of beam correspondence requirements for all power classes**Observation1:** Bit 0 UEs were introduced to help early PC3 UE implementations become functional in a nascent network environment. **Observation2:** All power classes must be treated in the beam correspondence requirement, like any other requirement.**Proposal:** Complete the beam correspondence requirement for FR2 UEs by including power classes other than PC3.**Moderator’s note:** The Tdoc number in the document content is incorrectly written as R4-2102664. |
| [**R4-2102664**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102664.zip)Type: CRFor: AgreementCAT: FRel-15 | Qualcomm, Nokia, Nokia Shanghai Bell, Samsung, Verizon, NTT Docomo, Sony, Ericsson | **Title:** CR to 38.101-2 on beam correspondence**Reason for change:**The beam correspondence requirement is incomplete without explicit treatment of all UE power classes.**Summary of change:**Add default condition to cover power classes not explicitly treated. |
| R4-2102665Type: CRFor: AgreementCAT: ARel-16 | Qualcomm, Nokia, Nokia Shanghai Bell, Samsung, Verizon, NTT Docomo, Sony, Ericsson | **Title:** CR to 38.101-2 on beam correspondence**Note:** The is the mirror CR of R4-2102664. |
| R4-2102666Type: CRFor: AgreementCAT: ARel-17 | Qualcomm, Nokia, Nokia Shanghai Bell, Samsung, Verizon, NTT Docomo, Sony, Ericsson | **Title:** CR to 38.101-2 on beam correspondence**Note:** The is the mirror CR of R4-2102664. |
| [**R4-2102925**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102925.zip)Type: DiscussionFor: Approval | Qualcomm Incorporated | **Title:** Completion of beam correspondence requirements for all power classes**Observation1:** Bit 0 UEs were introduced to help early PC3 UE implementations become functional in a nascent network environment. **Observation2:** All power classes must be treated in the beam correspondence requirement, like any other requirement.**Proposal:** Complete the beam correspondence requirement for FR2 UEs by including power classes other than PC3.**Moderator’s note:** This document is identical to R4-2102663 and looks to be a double-submission. |
|  |  |  |

## Open issues summary

**Issue 3.2-1: Is it agreeable to complete the beam correspondence requirement for FR2 UEs by including power classes other than PC3?**

### Option 1: Yes

### Option 2: No

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  | Issue 3.2-1: |
| OPPO | In our view it is not appropriate to introducing new requirements for Rel-15/16 at this stage. It is encouraged to bring these items to Rel-17 FR2 enhancement WID discussion. |
| Ericsson | Option 1 |
| Sony | **Issue 3.2-1: Is it agreeable to complete the beam correspondence requirement for FR2 UEs by including power classes other than PC3?** Option 1: Yes. BC is one of the most fundamental requirements for FR2 UEs, and thus the requirement should be completed for all type of devices.  |
| Apple | Option 1: Beam correspondence requirement is tied to the verification of EIRP requirements. Without beam correspondence requirement defined, it is not sure how EIRP requirements can be verified for other power classes. |
| Qualcomm | Option 1.To Oppo: This initiative is to complete the Rel-15 specification, we do not think it creates ‘new requirements’. BC after all is not a new requirement. |
| ZTE | Option 1. |
| vivo | Option 1 |
| Samsung | Yes, option 1. Current BC tolerance requirement for bit-0 UE was introduced only for PC3 at the later stage of Rel-15. So, adding something for bit-0 UE for other power class definitely needs further consensus in RAN4 and other WGs as we did before. Moreover, without the completion or approval of the CR, it is ambiguous and causes misunderstanding of the beam correspondence requirements for full 3GPP WGs |
| Xiaomi  | Option 1. |
| Huawei | Share the same view with OPPO. It is better to bring these items to Rel-17 FR2 enhancement WID, and discuss case by case how we define bit 1 and bit 0 requirement for each power class. |
| T-Mobile USA | Option 1 |
| NTT DOCOMO, INC | Option 1 |

### Comment collection for discussion papers

|  |  |
| --- | --- |
| **Tdoc number** | **Comments** |
| [**R4-2102663**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102663.zip) | **Title:** Completion of beam correspondence requirements for all power classes**Comments**:[OPPO] Same as Issue 3.2-1 |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2102664**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102664.zip) | **Title:** CR to 38.101-2 on beam correspondence |
| [OPPO] Wait for the outcome of Issue 3.2-1Ericsson: we support (and cosign) this CR.Apple: CR is agreeable. The DL resources side conditions may need to be revisited for different power classes if the CR is agreed in this meeting.Samsung: We support to approve the CR.Huawei: Not agreeable. It is better to bring these items to Rel-17 FR2 enhancement WID, and discuss case by case how we define bit 1 and bit 0 requirement for each power class.Qualcomm: to Huawei and Oppo. This is not a Rel-17 item. It is completion of Rel-15 requirements. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Issue 3.2-1** | **Is it agreeable to complete the beam correspondence requirement for FR2 UEs by including power classes other than PC3?**Option 1: Yes (Ericsson, Sony, Apple, Qualcomm, ZTE, vivo, Samsung, Xiaomi, T-Mobile USA, NTT DOCOMO)Option 2: No (OPPO, Huawei)**Status**: No agreement but with more companies supporting Option 1 |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2102664**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102664.zip) | To be revised (cover sheet error) |
|  |  |

### Discussion papers

|  |  |
| --- | --- |
| **Tdoc number** | **Status update recommendation**  |
| [**R4-2102663**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102663.zip) | Noted. It is suggested to focus on the agreement of the associated CR in 2nd round. |
| [**R4-2102925**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102925.zip) | Withdrawn (double submission, same contents as in R4-2102663) |

## Discussion on 2nd round (if applicable)

The following CR is returned to 2nd round to see if agreement can be reached with further clarifications or revisions.

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2103126 | **Title:** CR to 38.101-2 on beam correspondence |
| **MediaTek:** Make R15 & R16 BC requirement complete and clearer is important. However, we’d like to clarify whether we chance/place to discuss PC1/2/4 BC bit-0 requirement? |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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

# Topic #4: FR2 UE minimum output power requirement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2102662**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102662.zip)Type: DiscussionFor: Approval | Qualcomm Finland RFFE Oy | **Title:** Discussion on FR2 UE Min. Output Power Requirement**Observation 1:** The Pmin requirement represents inconsistent Tx SNR outcomes across CC bandwidths**Observation 2:** The Pmin requirement for the entire UL is different depending on whether a single CC or multiple narrower CCs make up a given UL signal bandwidth**Observation 3:** The per CC Pmin requirement is inconsistent between single layer and 2 layer UL.**Proposal 1:** For PC3, adopt a Pmin per CC limit as -13 + 10\*log(BWchannel /100 MHz) dBm.**Proposal 2:** For PC3, make the UL MIMO Pmin requirement (6.3D.1) consistent with the UL CA Pmin requirement by scaling it with baseband BW: ‘The minimum output power shall not exceed -13 + 10\*log(Number of UL layers \* BWchannel /100 MHz) dBm.’ |
| [**R4-2100586**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100586.zip)Type: CRFor: AgreementCAT: FRel-15 | Qualcomm Incorporated | **Title:** P\_min correction and P\_cmax CA correction to apply from all cells**Reason for change:**Consolidated CR addresses several topics that require some modification1. Pcmax CA correction: In previous meeting changes were done to the same section but what remains incorrect is that sentence: “The UE maximum configured power PCMAX in a transmission occasion is determined by the UL grants for carrier f(c) of each serving cell c”. It is confusing since it implies there are many grants but only one cell to look at for determining Pcmax. Pcmax for UE is defined above “total configured maximum output power PCMAX”. Pcmax for CA is determined by looking at all grants for all cells with simultaneous transmission occasion since MPR also is defined for CA so that allocation on all CC’s is used to determine the MPR. 2. The Pmin requirement is not consistent with either network requirement or UE physical ability. See R4-2102662. Consistency can be achieved by scaling Pmin requirement with baseband BW3. Include necessary wording changes missed in agreed R4-2011920, which clarified UE configuration for UL MIMO requirements.4. When UE switches transmission to the DL only (or PUSCH-less) carrier for SRS carrier switching, it is unable to maintain coherence on two antenna ports. This must be added to the list of exceptions of when UE is assumed to maintain coherence**Summary of change:**1. Pcmax: “each” is replaced by “all” and cell is changed to its plural cells2. Pmin: a. Single CC Pmin scales by BWb. ULMIMO Pmin scales by BW3. Missing ULMIMO wording clarification: Extend clarifications to UE configurations made in R4-2011920 to Pmin requirement also. Referenced CR only addressed peak EIRP and MPR requirements, but neglected to address Pmin, Tx modulation quality or Emissions4. Add SRS carrier switching to the list when UE is not required to maintain coherence |
| R4-2100587Type: CRFor: AgreementCAT: ARel-16 | Qualcomm Incorporated | **Title:** P\_min correction and P\_cmax CA correction to apply from all cells**Note:** The is the mirror CR of R4-2100586 |
| R4-2100588Type: CRFor: AgreementCAT: ARel-17 | Qualcomm Incorporated | **Title:** P\_min correction and P\_cmax CA correction to apply from all cells**Note:** The is the mirror CR of R4-2100586 |
| [**R4-2102924**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102924.zip)Type: DiscussionFor: Approval | Qualcomm Incorporated | **Title:** Discussion on FR2 UE Min. Output Power Requirement**Observation 1:** The Pmin requirement represents inconsistent Tx SNR outcomes across CC bandwidths**Observation 2:** The Pmin requirement for the entire UL is different depending on whether a single CC or multiple narrower CCs make up a given UL signal bandwidth**Observation 3:** The per CC Pmin requirement is inconsistent between single layer and 2 layer UL.**Proposal 1:** For PC3, adopt a Pmin per CC limit as -13 + 10\*log(BWchannel /100 MHz) dBm.**Proposal 2:** For PC3, make the UL MIMO Pmin requirement (6.3D.1) consistent with the UL CA Pmin requirement by scaling it with baseband BW: ‘The minimum output power shall not exceed -13 + 10\*log(Number of UL layers \* BWchannel /100 MHz) dBm.’**Moderator’s note:** This document is identical to R4-2102662 and looks to be a double-submission. |

## Open issues summary

**Issue 4.2-1: Is it agreeable to adopt a Pmin per CC limit as -13 + 10\*log(BWchannel /100 MHz) dBm?**

### Option 1: Yes

### Option 2: No

**Issue 4.2-2: Is it agreeable to scale Pmin for UL MIMO by -13 + 10\*log(Number of UL layers \* BWchannel /100 MHz) dBm**

### Option 1: Yes

### Option 2: No

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  | Issue 4.2-1:Issue 4.2-2: |
| OPPO | **Issue 4.2-1: Is it agreeable to adopt a Pmin per CC limit as -13 + 10\*log(BWchannel /100 MHz) dBm?** Option 2, the idea is ok, but if we use 100MHz as the reference CBW then for the 50MHz requirements will be tightened by 3dB. Then if this concept is ok to all companies it is suggested to use 50MHz as reference CBW or keep 50MHz unchanged and adjust other CBW based on 100MHz reference CBW.**Issue 4.2-2: Is it agreeable to scale Pmin for UL MIMO by -13 + 10\*log(Number of UL layers \* BWchannel /100 MHz) dBm** Same comment as issue 4.2-1 |
| Ericsson: | **Issue 4.2-1:**Some merit in scaling Pmin for large allocations for wider BW, similar to the case for intra-band UL CA in FR1 (scaling for >20 MHz CHBW) due to limited TX SNR (EVM). However, the UE shall be able to reduce its power to at Pmin by TPC for all RB allocations (down to 1 PRB) to achieve the target received BS power. An alternative solution could be a maximum output power per carrier but with a side condition on a minimum PSD: then -13 dBm would apply for small allocations down to 1 PRB, but higher Pmin would be allowed for larger allocations. But admittedly a more complex specification, the real problem is the maximum UE output power. **Issue 4.2-2**For UL-MIMO the power is split between the layers (PUSCH) so a scaling could be motivated if limited by TX SNR, but for e.g. for hybrid BF the layers would be split into two separate chains per polarization -- then no need for scaling w r t minimum TX SNR? |
| Apple | **Issue 4.2-1:** Option 1**Issue 4.2-2**: Option 1 |
| Qualcomm | To Ericsson: Pmin continues to be insensitive to RF allocation, so the UE would continue to ‘*be able to reduce its power to at Pmin by TPC for all RB allocations (down to 1 PRB) to achieve the target received BS power*’.At low powers, regardless of UL MIMO, CA or single CC configuration, Tx EVM is indeed gated by Tx SNR. This is the motivation to align EVM-compliant Pmin to baseband BW. (justification for scaling by layers is the same as justification for scaling by number of CCs in CA) |
| ZTE | Sharing similar view with OPPO. The minimum supported channel bandwidth for FR2 band is 50MHz, not sure why 100MHz is selected for scaling? |
| vivo | We share same view with OPPO and ZTE, 50MHz should be selected as reference.  |
| Samsung | Issue 4.2-1: Option 1We share similar understanding with Ericsson related to different RB allocations but scaling with RBs is not easy to be specified, we are fine with Pmin power scaling just with BWs regardless of RB allocations.Issue 4.2-2: Option 1Technical reason is the same as issue 4.2-1 on Pmin |
| Xiaomi | Agree with 50MHz scaling reference.Agree with the idea as scaling with number of layers for UL-MIMO. |
| Huawei | It is not reasonable, note there is statement in the current spec:*“The minimum controlled output power of the UE is defined as the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.”*We need to ensure under wider BW, the power on even 1RB could reach gNB target power.For UL MIMO, we don’t have such scaling approach, we do not accept to have different Pmin definition here. |
| Qualcomm | To Huawei: The Pmin requirement is agnostic of RB allocation. Is there a concern with that aspect?For consistency, all Pmin requirements should be scaled by baseband BW. CA already does so. This is why it makes sense for UL MIMO to follow the same rule. |
| NTT DOCOMO, INC. | We would like to further discuss it in 2nd round. Even if we introduce scaling approach, we would like to keep the requirements for 100MHz CBW in single CC as original proposal.Question for our understanding is that why the CR does not change CA requirement according to change of single CC requirement given that minimum output power for CA is specified per CC. |

### Comment collection for discussion papers

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| **Tdoc number** | **Comments** |
| [**R4-2102662**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102662.zip) | **Title:** Discussion on FR2 UE Min. Output Power Requirement**Comments**: |

### CRs/TPs/LSs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| [**R4-2100586**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100586.zip) | **Title:** P\_min correction and P\_cmax CA correction to apply from all cells |
| [OPPO] Wait for the outcome of Issue 4.2-1 and Issue 4.2-2.Ericsson: decision in the second round.Apple: CR is agreeable.Samsung: The change on power scaling for Pmin, UL MIMO and EVM is agreeable. Thanks for introducing ULFPTx into related UL MIMO sections. Would like some clarification about the revision to “6.4D.4 Requirements for coherent UL MIMO”, i.e. if it is the consensus that clause 6.4D.4 is only applicable for coherent UE, and if the “coherent UL MIMO TPMI” wording means 2Tx TPMI (TPMI index=2 for 1 layer; TPMI=0 for 2 layer)? If yes, the related change is also agreeable.Huawei: Not agreeable.Qualcomm: To Samsung, our understanding is the same as yours.NTT DOCOMO, INC:We would like to further discuss it in 2nd round. Even if we introduce scaling approach, we would like to keep the requirements for 100MHz CBW in single CC as original proposal.Question for our understanding is that why the CR does not change CA requirement according to change of single CC requirement given that minimum output power for CA is specified per CC. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
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|  | **Status summary**  |
| **Issue 4.2-1** | **Is it agreeable to adopt a Pmin per CC limit as -13 + 10\*log(BWchannel /100 MHz) dBm?**Option 1: Yes (Qualcomm, Apple, Samsung)Option 2: No (Huawei)Option 3: Pmin per CC limit as -13 + 10\*log(BWchannel /50 MHz) dBm (OPPO, Apple, ZTE, vivo, Xiaomi)**Status**: No agreement but the concept of scaling with CBW seems acceptable. |
| **Issue 4.2-2** | **Is it agreeable to scale Pmin for UL MIMO by -13 + 10\*log(Number of UL layers \* BWchannel /100 MHz) dBm?**Option 1: Yes (Qualcomm, Apple, Samsung)Option 2: No (Ericsson, Huawei)Option 3: Pmin per CC limit as -13 + 10\*log(Number of UL layers \*BWchannel /50 MHz) dBm (OPPO, Apple, ZTE, vivo, Xiaomi)**Status**: No agreement but the concept of scaling seems acceptable. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2100586**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100586.zip) | To be revised |
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### Discussion papers

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| **Tdoc number** | **Status update recommendation**  |
| [**R4-2102662**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102662.zip) | Noted. It is suggested to focus on the agreement of the associated CR in 2nd round. |
| [**R4-2102924**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102924.zip) | Withdrawn (double submission, same contents as in R4-2102662) |

## Discussion on 2nd round (if applicable)

The following CRs are returned to 2nd round to see if agreement can be reached with further clarifications or revisions.

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| **CR/TP number** | **Comments collection** |
| R4-2103127 | **Title:** P\_min correction and P\_cmax CA correction to apply from all cells |
| Qualcomm: We can come re-convene on P\_min in our next meeting. We can pull out all P\_min related items out of the CR. The original CR also contained other maintenance items which are hopefully agreeable, there were no comments. The de-contented CR is here: https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_98\_e/Inbox/Drafts/%5B98e%5D%5B103%5D%20NR\_NewRAT\_UE\_RF\_Part\_2/2nd%20Round/draft\_R4-2103127%20CR\_%200320%20Cat-F%20TS%2038.101-2%20R15%20P\_cmax%20CA%20correction%20to%20apply%20from%20all%20cells.docx |
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## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
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# Topic #5: Other CRs

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2102677**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102677.zip)Type: CRFor: AgreementCAT: FRel-16 | Ericsson | **Title:** Frequency separation class clarification**Reason for change:**Clarification of Frequency Separation classes to TS38.331.At RAN2#111-e (August 2020) two Rel-16 CRs to TS38.331 (R2-2008463) and TS38.306 (R2-2008462) where agreed.Those CRs makes a clarifying update to the specifications according to an RAN4 agreement stated in an LS to RAN2 in (R2-2006174 (R4-2009294)) Titled “LS on Frequency separation class for DL-only spectrum for FR2”In TS38.331 previously stated:-----------------------------FreqSeparationClass ::= ENUMERATED {c1, c2, c3, ...}Where the values c1, c2, c3 correspond to the values defined in TS38.101-2, Table 5.3A.4-2.-----------------------------After the change the I.E now indicates explicit values:FreqSeparationClass ::= ENUMERATED { mhz800, mhz1200, mhz1400, ...}And the new I.E for Frequency separation Class DL is added as:FreqSeparationClassDL-Only-r16 ::= ENUMERATED {mhz200, mhz400, mhz600, mhz800, mhz1000, mhz1200} ----------------------------In this paper 38.101-2 is aligned with the updated signaling by adding a note in tables 5.3A.4-2 and 5.3A.4-3 that clarifies the new signaling.**Summary of change:**A clarifying note is added to tables 5.3A.4-2 and 5.3A.4-3 |
| R4-2102678Type: CRFor: AgreementCAT: ARel-17 | Ericsson | **Title:** Frequency separation class clarification**Note:** The is the mirror CR of R4-2102677 |
| [**R4-2102716**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102716.zip)Type: CRFor: AgreementCAT: FRel-16 | Huawei, HiSilicon | **Title:** CR for intra-band UL CA MPR**Reason for change:**CA MPR is lack of definition for PUCCH/SRS, and there is wording error for CA RBstart definition.**Summary of change:**1. Add CA MPR for PUCCH/PRACH/SRS2. Correct definition for CA RBstart |
| R4-2102815 Type: CRFor: AgreementCAT: ARel-17 | Huawei, HiSilicon | **Title:** CR for intra-band UL CA MPR**Note:** The is the mirror CR of R4-2102716 |

## Open issues summary

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
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### Comment collection for discussion papers

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| **Tdoc number** | **Comments** |
|  | **Title:** **Comments**: |

### CRs/TPs/LSs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| [**R4-2102677**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102677.zip) | **Title:** Frequency separation class clarification |
| [OPPO] In our view, there is no needed to specify in RAN4 spec saying that the freq separation class is signaled.Apple: Is such clarification really needed in RAN4 specifications? It does not look like RAN2 would be confused by RAN4 spec. without this note.Qualcomm:1. How is the note content relevant to RAN4? (what information was missing without note?)
2. Why would the note contents not be in the body? The note seems common to all rows.

If we think a note is necessary, we should also highlight that one subset of the table is signaled with one IE and the other subset is signaled with a second IE Nokia: We do not see a need to add RAN2 signaling details to RAN4 specification on this matter. It is enough to simply refer to *FreqSeparationClass* and *FreqSeparationClassDL-Only*. |
| [**R4-2102716**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102716.zip) | **Title:** CR for intra-band UL CA MPR |
| Qualcomm: MPR for PUCCH format 0,1,3, 4, SRS should be closer to that CA DFT-s-QPSK because the signal PAPR is equivalent to or less than that of CA DFT-s-QPSKPUCCH format 2 is CP-OFDM based, so we can see how CA CP-OFDM QPSK MPR appliesThe approach above is used for single CC MPR. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2102677**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102677.zip) | NotedModerator’s note: It is unlikely this CR can be agreed in this meeting. |
| R4-2102678 | Withdrawn (Rel-17 mirror CR of R4-2102677) |
| [**R4-2102716**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102716.zip) | Return to 2nd round (to be revised).Moderator’s note: Proponent to address Qualcomm’s first round comment. |

## Discussion on 2nd round (if applicable)

The following CRs are returned to 2nd round to see if agreement can be reached with further clarifications or revisions.

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| **CR/TP number** | **Comments collection** |
| R4-2103348 (revision of R4-2102716) | **Title:** CR for intra-band UL CA MPR (CR on FR2 intra-band UL CA in Chairman’s notes) |
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## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
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