**3GPP TSG-RAN WG4 Meeting #102-e R4-2206316**

**Electronic Meeting, February 21 – March 3, 2022**

**Agenda item:** 9.30

**Source:** Moderator (China Telecom)

**Title:** Email discussion summary for [102-e][116] NR\_PC2\_SUL\_CA\_lowMSD

**Document for:** Information

# Introduction

This discussion summary will cover two agendas:

9.30 High power UE (power class 2) for NR inter-band Carrier Aggregation with 2 bands downlink and 2 bands uplink

9.32 Power Class 2 UE for NR inter-band CA and SUL configurations with x (x>2) bands DL and y (y=1, 2) bands UL

According to the contributions submitted, this discussion summary will focus on the following topics:

* Topic#1: [9.30] NR\_PC2\_CA\_R17\_2BDL\_2BUL
  + Sub-topic 1-1: Corrections
  + Sub-topic 1-2: [2DL/2UL/1UL]TPs/draft CRs to introduce UE requirements for combos
* Topic#2: [9.32] NR\_UE\_PC2\_R17\_CADC\_SUL\_xBDL\_yBUL
  + Sub-topic 2-1: MSD NRCA 3DL 2UL
  + Sub-topic 2-2: [3DL/2UL]TPs/draft CRs to introduce UE requirements for combos

Note that the tables for collecting comments for sub-topic issues are arranged just below each issue...

# Topic #1: [9.30] NR\_PC2\_CA\_R17\_2BDL\_2BUL

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations/Abstracts** |
| R4-2203631 | China Telecom Corporation Ltd. | Correct the descriptions on power class requirements applications in clause 6.2A.1.1, 6.2A.1.2 and 6.2A.1.3 to make them aligned across inter-band CA, intra-band CA, with one uplink carrier |
| R4-2203829 | Verizon Denmark | This is a text proposal to include MSD due to cross band isolation for the approved PC2 CA\_n2-n77 combo |
| R4-2203830 | Verizon Denmark | This is a text proposal to include MSD due to cross band isolation for the approved PC2 CA\_n66-n77 combo |
| [R4-2205725](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205725.zip) | Ericsson, Telstra | TP for TR 38.841 to add CA\_n5-n78 |
| [R4-2205726](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205726.zip) | Ericsson, Telstra | TP for TR 38.841 to add CA\_n7-n78 |
| [R4-2205727](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205727.zip) | Ericsson, Telstra | TP for TR 38.841 to add CA\_n28-n78 |
| [R4-2205927](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205927.zip) | T-Mobile USA, Interdigital, Skyworks Solutions, Inc. | Corrects the Pcmax equations to change Ppowerclass to Ppowerclass,CA in a few places. Clarifies that the uplink CA clauses are identified as for uplink CA. Corrects errors in the MSD tables. |
| [R4-2205928](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205928.zip) | T-Mobile USA | This contribution is a text proposal to introduce PC1.5 n77 for DL CA\_n25A-n77A, and also to correct the PC2 MSD. |
| [R4-2205929](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205929.zip) | T-Mobile USA | This contribution is a text proposal to introduce PC1.5 n77 for DL CA\_n41A-n77A, and also PC2 UL CA and PC2 and PC1.5 single band n77 for CA\_n41(2A)-n77A, CA\_n41C-n77A, and CA\_n41A-n77(2A).  This contribution also proposes correcting the harmonic MSD for PC3 n77 into n41. The MSD is currently 10.4 dB for all victim channel bandwidths. The proposal is to use the same MSD as n78 into n41.  Table 5.13.1-1 is updated with Note 8 for PC2 and Note 9 for PC1.5 |
| [R4-2205930](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205930.zip) | T-Mobile USA | This contribution is a text proposal to introduce PC1.5 n77 for DL CA\_n66A-n77A. |
| [R4-2205931](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205931.zip) | T-Mobile USA | This contribution is a text proposal to introduce PC1.5 n77 for DL CA\_n71A-n77A. There is no impact of n77 PC1.5 to MSD.  Table 5.14.1-1 is updated with Note 9 for PC1.5, and also with Note 8 for PC2, which reflects what is in 38.101-1 already |
| [R4-2205932](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205932.zip) | T-Mobile USA | This draft CR adds support for PC2 and PC1.5 for single uplink carrier n77 and PC2 for UL CA\_n25A-n77A for:  CA\_n25A-n77A |
| [R4-2205933](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205933.zip) | T-Mobile USA | This draft CR adds support for PC2 and PC1.5 for single uplink carrier n41 and n77 and PC2 for UL CA\_n41A-n77A for DL CA combinations with n41 and n77:  CA\_n41A-n77A  CA\_n41(2A)-n77A  CA\_n41C-n77A  CA\_n41A-n77(2A) |
| [R4-2205934](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205934.zip) | T-Mobile USA | This draft CR adds support for PC1.5 for single uplink carrier n77 for DL CA combinations with n66 and n77:  CA\_n66A-n77A  CA\_n66A-n77(2A) |
| [R4-2205935](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205935.zip) | T-Mobile USA | This draft CR adds support for PC1.5 for single uplink carrier n77 DL CA\_n71A-n77A |

## Open issues summary

### Sub-topic 1-1: Corrections

**Proposal:**

* (Draft CR R4-2203631):Correct the descriptions on power class requirements applications in clause 6.2A.1.1, 6.2A.1.2 and 6.2A.1.3 to make them aligned across inter-band CA, intra-band CA, with one uplink carrier
* (Draft CR [R4-2205927](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205927.zip)): Corrects the Pcmax equations to change Ppowerclass to Ppowerclass,CA in a few places. Clarifies that the uplink CA clauses are identified as for uplink CA. Corrects errors in the MSD tables.

**Recommended WF:**

* Collect views on these two draft CRs, if no comments for certain of draft CR, the draft CR will be recommended as approved.

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| **CR/TP number** | **Comments collection for Sub-topic 1-1: Corrections** |
| R4-2203631 | Nokia: Regarding the first and second changes of adding “power class 3”, this may not be true. Some TDD bands would be able to use PC2 or PC1.5 as signal band operation, wouldn’t them?  We’d like to understand what the texts were intended for?  For other supported power class except class 3 inter-band downlink carrier aggregation with one uplink carrier assigned to one NR band as listed in clause 5.5A.1, the maximum output power for the supported power class is specified in Table 6.2.1-1. |
| ZTE: For the changes for intra-band, we have same question with Nokia, why add contents related to inter-band for intra-band band? The reason in the CR cover is to align the description cross intra-band/inter-band, however, there were no such changes for intra-band non-contiguous CA.  For the changes for inter-band, why delete ‘ The period of measurement shall be at least one sub frame (1 ms)’, rather than adding it for intra-band C/NC CA?  Moreover, not sure why it is necessary to align the descriptions for intra-band/inter-band CA. Also, we see the descriptions are not exactly alignment cross intra-band/inter-band CA in this CR. |
| T-Mobile USA:  We agree that corrections and clarifications are needed, but don’t agree with some of the changes. We also think that the clauses could be simplified. We have proposed a revised Draft CR in the inbox ending in TMUS. |
| Huawei: It’s better to avoid “power class x” in front of “downlink”. If we understand the intention of the CR correctly, the following wording is suggested for 6.2A.1.1:  “For downlink intra-band contiguous carrier aggregation with a single uplink component carrier configured in the NR band, the supported power classes are specified in Table 5.5A.1-1 and the corresponding maximum output power is specified in Table 6.2.1-1.”  Similar changes can be made to 6.2A.1.2, 6.2A.1.3 if needed. |
| Verizon: Agree with Nokia comment above, and it would bring in confusion from adding “power class 3” here. |
| Skyworks: Even if we understand the intention, we are also confused by some of the power class additions and some of the text should not be removed. |
| CTC: To Nokia, ZTE and Verizon, I am sorry for the mistaken wording for intra-band changes, my intended text shall be like below, I think this will address the misunderstanding.  For other supported power class except class 3 int~~er~~ra-band downlink carrier aggregation with one uplink carrier assigned to one NR band as listed in clause 5.5A.1, the maximum output power for the supported power class is specified in Table 6.2.1-1.  To T-Mobile USA and Huawei, many thanks for the revision and suggestion, we are ok with the changes from T-Mobile which reflected our intention. Regarding Huawei’s suggestion, we think it is necessary to explicitly indicate the power class 3 and other power classes, because they are defined in different tables. This is also one of the motivation of the CR based on received related comments from RAN5, they are confused by looking for power class 2 CA definition.  With above clarification, we made minor correction for the referred table number. The revised CR was uploaded in the round 1 folder ending with CTC. |
| AT&T: We cannot agree with the CR as is. We agree with the revision provided by T-Mobile USA with the clause number corrections provided by CTC. |
| Huawei: Revision#02 looks acceptable, but would like to suggest a minor change if it’s ok for other companies. For example, in clause 6.2A.1.1:  *For downlink intra-band contiguous carrier aggregation with a single uplink component carrier configured in the NR band, the maximum output power is specified in Table 6.2.1-1 for power class 3 ~~or for~~ and other power classes ~~as~~ if indicated in clause 5.5A.1.*  If agreed, similar changes apply to 6.2A.1.2, 6.2A.1.3. Rev3 is provided in the same folder. |
| [R4-2205927](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205927.zip) | ZTE: First, this CR is for Rel-17 CR, however, with the corrections in this CR, the sub-clauses title are not the same cross Rel-15/16 and Rel-17 spec. For Tx requirements, it is for UL CA and for Rx requirements, it is for DL CA, it seems it is clear.  In sub-clause 7.3A.4 and 7.3A.6, we prefer to keep ‘for either PC3 or PC2 CA’ in the table title. |
| T-Mobile USA: We would be OK keeping the sub-clause titles as they were rather than changing Re—16 and Rel-17 if that is acceptable to Skyworks who suggested the change offline.  We would be OK with keeping ‘for either PC3 or PC2 CA’ in the table title if that is acceptable to Skyworks who suggested the changes offline. |
| Huawei: We support the changes in general. It’s beneficial to be clear whether the CA refers to DL or UL. And it’s important to state the aggressor’s power class, while the power class of the UL CA may not be necessary.  We’d like to suggest some minor revisions to match the changes. For example, in 7.3A.4:  “Sensitivity degradation is allowed for a band in frequency range 1 if it is impacted by UL harmonic interference from another band which belongs to PC3 NR band in frequency range 1 of the same CA configuration”  Maybe “PC3” above should be removed, since the aggressor could be PC3, PC2, or even PC1.5.  Similar changes may be needed for other sections including 7.3A.6. |
| Skyworks: If changing clause title is an issue we are OK to not change them and possibly providing the clarification within the first text in the para graph.  Regarding the MSD table title it should be clear that the only table that is dependent on the CA\_power class is the dual UL IMD tables. Any MSD table related to single UL (single CC) is only dependent on the power on this band. even for a PC2 inter-band CA, one band/both bands may still be limited to PC3. Also a PC1.5 band can only achieve PC1.5 in a single band configuration, it is then PC2 or PC3 in an inter-band CA configuration depending on the CA power. The aim of these changes is to make clear which MSD table applies depending on the band actual power for single UL interference and the CA power for dual UL interference. |
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### Sub-topic 1-2: [2DL/2UL/1UL]TPs/draft CRs to introduce UE requirements for combos

**Proposed CRs/TP:**

* R4-2203829 TP for TR 38.841: CA\_n2-n77
* R4-2203830 TP for TR 38.841: CA\_n66-n77
* R4-2205725 TP for TR 38.841 to add CA\_n5-n78
* R4-2205726 TP for TR 38.841 to add CA\_n7-n78
* R4-2205727 TP for TR 38.841 to add CA\_n28-n78
* R4-2205928 TP for TR38.841: PC2 and PC1.5 n77 for CA\_n25A-n77A
* R4-2205929 TP for TR38.841: PC2 and PC1.5 n77 for CA\_n41A-n77A
* R4-2205930 TP for TR38.841: PC2 and PC1.5 n77 for CA\_n66A-n77A
* R4-2205931 TP for TR38.841: PC1.5 n77 for CA\_n71A-n77A
* R4-2205932 Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n25 and n77
* R4-2205933 Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n41 and n77
* R4-2205934 Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n66 and n77
* R4-2205935 Draft CR for 38.101-1: Addition of n77 PC1.5 for DL CA\_n71A-n77A

**Recommended WF:**

* Collect the comments for proposed TP and draft CRs. If no comments for certain of TP or draft CR, the TP or draft CR will be recommended as approved.

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| **CR/TP number** | **Comments collection for [2DL/2UL/1UL]TPs/draft CRs to introduce UE requirements for combos** |
| R4-2203829 | ZTE: 25/30/40MHz channel bandwidths are not supported for band n2 in table 5.5.1-1. So there are no need to specfy the cross band isolation MSD values for band n2 25/30/40MHz |
| T-Mobile USA: We don’t agree with 10.5 dB of cross-band isolation for PC2 n77 into n2. We think that 1.5 dB is appropriate as proposed in R4-2205928 for CA\_n25-n77. |
| Verizon:  To ZTE, we will update the band n2 in table 5.5.1-1 for the missed 25/30/40MHz channel bandwidths  To T-Mobile USA, we double check the MSD for cross-band isolation in our proposal, and it should be updated to 6dBm after considering the IMD2 impact. Sorry, we used a wrong initial value in! However, we do not agree to reuse the same 1.5dB value from CA\_n25-n77 as it does not reflect the IMD2 impact interference appropriately. |
| Skyworks: Even if there is no cross band MSD for 23dBm n77 case, we agree there can be one for 26dBm ntt case, but we would assume it should be relatively low. Could you clarify if the cross band MSD number is also accounting for IMD2? But in that case if n77 is at 26dBm then n2 should be at low power no? |
| Verizon to Skyworks,  It was an agreement, i.e., to consider the strongest interference in MSD for mixing and cross-band interference. As the band n2 is a victim and the IMD2 is the strongest interference as indicated in section 5.5.3.1 of this contribution, MSD would be twice (x2) values in the cross-band interference from without IMD.  If this is no longer a common case, as an operator we are happy to lower down this number. |
| AT&T: We don’t agree with 10.5dB for cross-band isolation MSD for PC2 n77 into n2. We also don’t agree with the updated value of 6dB as suggested by Verizon. Although, we question the overall need for additional MSD for PC2 n77 into n2, we are OK to re-use the same value proposed for CA\_n25-n77. We would also like to see the MSD for PC2 n77 into n2 match any updates made based on our comments on R4-2205932. |
| Skyworks to Verizon: yes for single UL cases (harmonics, harmonic mixing, cross band) we need to use the maximum power of the UL interferer but then the other UL can only be at low power, this is why we do not understand the IMD2 contribution to the cross band case. this should be tested with equal UL power only in the IMD test. If IMD2 is present in the cross band case then it should be clarified if the UE will be tested in this condition. |
| Apple: We suggest to follow the existing PC3 2UL IMD test configurations for CA\_n2-n77 as one of the test configuration in this TP uses 3690MHz for n77 which would not be allowed in US.  Please also clarify why cross-band isolation is caused by IMD2? |
| R4-2203830 | T-Mobile USA: We don’t agree with 10.5 dB of cross-band isolation for PC2 n77 into n66. We think that 1.5 dB is appropriate as proposed in R4-2205930 for CA\_n25-n77. We think that this draft CR can be noted because it overlaps with R4-2205930. |
| Verizon:  To T-Mobile USA, we double check the MSD for cross-band isolation in our proposal, and it should be updated to 6dBm after considering the IMD2 impact. Sorry, we used a wrong initial value in! However, we do not agree to reuse the same 1.5dB value from CA\_n25-n77 as it does not reflect the IMD2 impact interference appropriately. |
| Skyworks: Same question than for R4-2203829. It is important that we have a common understanding as the MSD issues are similar for all FDD mid-bands associated with n77. |
| Verizon: To Skyworks,  It was an agreement, i.e., to consider the strongest interference in MSD for mixing and cross-band interference. As the band n66 is a victim and the IMD2 is the strongest interference as indicated in section 5.7.3.1 of this contribution, MSD would be twice (x2) values in the cross-band interference from without IMD.  If this is no longer a common case, as an operator we are happy to lower down this number. |
| AT&T: We don’t agree with 10.5dB for cross-band isolation MSD for PC2 n77 into n66. We also don’t agree with the updated value of 6dB as suggested by Verizon. We are OK to re-use the same value proposed for CA\_n66-n77 in R4-2205934. |
| Apple: We suggest to follow the existing PC3 2UL IMD test configurations for CA\_n66-n77 as one of the test configuration in this TP uses 3660MHz for n77 which would not be allowed in US.  Please also clarify why cross-band isolation is caused by IMD2? |
| R4-2205725 | Skyworks: with n78 at 26dBm, there may be some cross band MSD since it is introduced for MBs+n77 |
| Ericsson: We don’t see that cross band MSD is needed for CA\_n5-n78 |
| Skyworks: Sorry we typed our comment in the wrong row: our comment was for CA\_n7-n78 |
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| R4-2205726 | Ericsson: Update where also cross-band isolation is defined: [revision of R4-2205726 TP for TR 38.841 to add CA\_n7-n78](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B116%5D%20NR_PC2_SUL_CA_lowMSD/Round%201/revision%20of%20R4-2205726%20TP%20for%20TR%2038.841%20to%20add%20CA_n7-n78.docx) |
| T-Mobile USA: We agree with the revision. Thanks to Ericsson for addressing our pre-meeting comment. |
| Skyworks: note sure about the note on harmonic mixing for Table 5.x.3.2-1 since there s no harmonic mixing exception specified |
| Ericsson: 2nd update provided where the note on harmonic mixing is removed: [revision 2 of R4-2205726 TP for TR 38.841 to add CA\_n7-n78](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B116%5D%20NR_PC2_SUL_CA_lowMSD/Round%201/revision%202%20of%20R4-2205726%20TP%20for%20TR%2038.841%20to%20add%20CA_n7-n78.docx) |
| Skyworks: with n78 at 26dBm, there may be some cross band MSD since it is introduced for MBs+n77. You can base the value on the CA\_n41-n77 case that use exactly the same frequencies. |
| R4-2205727 | Ericsson: In R4-2205727 harmonic mixing MSD for CA\_n28-n78 is defined for PC2. But we want to highlight that MSD for CA\_n28-n78 PC3 is missing and would preferably also need to be defined |
| ZTE: it said “4th harmonic mixing products” above sub-clause 5.x.3.1, however, the note 1 is for 5th in table 5.x.3.1-1.  Actually, there is no need to specify the harmonic/harmonic mixing MSD for PC2 FDD+TDD CA if the aggressor band is FDD band(i.e. m\*FDD DL = n\*TDD UL)), seems it is the same with the corresponding PC3 inter-band CA. So we think the MSD should be defined for PC3 inter-band CA since it was missed, rather in PC2 inter-band CA. The MSD values for PC2 are just the same with PC3. |
| T-Mobile USA: We agree with Ericsson that PC3 harmonic MSD for CA\_n28-n78 is missing and should be added. Even though this is a PC2 WI we would be fine with adding the PC3 MSD for consistency. Thanks to Ericsson for responding to our pre-meeting comment.  To ZTE:\_UL single band PC2 on n78 for CA\_n28A-n78A is included in the WID, so MSD for PC2 aggressor for n78 is appropriate. |
| Skyworks: harmonic mixing for PC3 is also defined for n29 with n77 UL (5xn29DL=n77UL) at 31dB for 5MHz |
| Apple: There is no 4th order harmonic mixing. It should be 5th order ~~without direct overlap. Need a clarification on how MSD was derived.~~ |
| R4-2205928 R4-2205932 | Verizon: |
| Skyworks:  on R4-2205928, there is cross band for CA\_n25-n77(PC1.5). is there the same for n77(PC2) or in the PC2 table was n77 n25 intended instead of n77 n66?  R4-2205928 : Table 5.13.3.6-1 should be PC1.5 not PC2. Tables call for n66 instead on n25 |
| AT&T: For R4-2205928 and R4-2205932, there are two instances where n66 is mentioned but the band should be listed as n25. In R4-2205932, the UL configuration table should be updated to use n25 SCS and RB allocations for the CBW of the DL band as it presently shows n66 values. In addition, it seems strange that the level of cross-band interference for n77 PC2 into n25 is within 0.1dB of the MSD value for n41 into n25. Also, it seems strange that the level of cross-band interference for n77 PC1.5 into n25 is actually higher than the MSD value for n41 into n25. Taking the same MSD values as PC2/PC1.5 n77 into n66 also seems to be conservative. |
| Skyworks: at large frequency offsets the transmitter noise is flat and increases at least dB/dB with PC2 and PC1.5 vs PC3. Then the noise level in a given band depends on where the diplexer and n77 filter may fly back. It could be around the MB frequencies of 2, 25, 66 or near 41, 7 thus it is not necessarily true that the further bands see less interference for bands that are within the same diplexing (2,25,66,41,7 are combined into the same diplexer in some implementations). |
| Apple: We suggest to revise 2UL IMD4 test configuration to move n77 frequency away from 3690MHz if available. The configuration in current specifications may need to be revised as well. |
| R4-2205929 R4-2205933 |  |
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| R4-2205930 R4-2205934 | Skyworks: in R4-2205930 Table 5.13.3.6-1 it should be PC1.5 in title |
| AT&T: For R4-2205934, the UL configuration table is missing the configuration for 25MHz CBW for the CBW of the DL band. |
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| R4-2205931 R4-2205935 |  |
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## 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 1-1: Corrections | **Recommended WF:**   * No further comments to the latest draft rev of [Rev\_R4-2203631 Draft CR to 38.101-1 Correct the descriptions on power class requirements...v03\_CTC\_HW.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B116%5D%20NR_PC2_SUL_CA_lowMSD/Round%201/Rev_R4-2203631%20Draft%20CR%20to%2038.101-1%20Correct%20the%20descriptions%20on%20power%20class%20requirements...v03_CTC_HW.docx), this draft revision is recommended as agreeable. * No further comments to the latest draft rev of [Rev\_R4-2205927\_Draft\_CR\_38101-1-h40\_s06-XX\_PC2\_CA\_Corrections.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B116%5D%20NR_PC2_SUL_CA_lowMSD/Round%201/Rev_R4-2205927_Draft_CR_38101-1-h40_s06-XX_PC2_CA_Corrections.docx), this draft revision is recommended as agreeable. |
| Sub-topic 1-2: [2DL/2UL/1UL]TPs/draft CRs to introduce UE requirements for combos | **Recommended WF:**   * R4-2203829 TP for TR 38.841: CA\_n2-n77 is recommended as revised. * R4-2203830 TP for TR 38.841: CA\_n66-n77 is recommended as revised. * R4-2205725 TP for TR 38.841 to add CA\_n5-n78 is recommended as approved * R4-2205726 TP for TR 38.841 to add CA\_n7-n78 is recommended as revised * R4-2205727 TP for TR 38.841 to add CA\_n28-n78 is recommended as revised * R4-2205928 TP for TR38.841: PC2 and PC1.5 n77 for CA\_n25A-n77A is recommended as revised * R4-2205929 TP for TR38.841: PC2 and PC1.5 n77 for CA\_n41A-n77A is recommended as approved * R4-2205930 TP for TR38.841: PC2 and PC1.5 n77 for CA\_n66A-n77A is recommended as revised * R4-2205931 TP for TR38.841: PC1.5 n77 for CA\_n71A-n77A is recommended as approved * R4-2205932 Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n25 and n77 is recommended as revised * R4-2205933 Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n41 and n77 is recommended as endorsed * R4-2205934 Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n66 and n77 is recommended as revised * R4-2205935 Draft CR for 38.101-1: Addition of n77 PC1.5 for DL CA\_n71A-n77A is recommended as endorsed |

## Discussion on 2nd round

### Sub-topic 1-1(2nd round): Corrections

**Recommended WF**:

* Closed, according the summary in 1st round, please upload the formal tdoc for Rev of R4-2203631 and Rev of R4-2205927.

### Sub-topic 1-2(2nd round): [2DL/2UL/1UL]TPs/draft CRs to introduce UE requirements for combos

**Recommended WF**: Continue discuss the revised TPs/draft CRs.

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| **CR/TP number** | **Comments collection for Sub-topic 1-2(2nd round): [2DL/2UL/1UL]TPs/draft CRs to introduce UE requirements for combos** |
| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2203829 | TP for TR 38.841: CA\_n2-n77 |
| [Verizon] Here is link of revision [Rev R4-2203829 TP for TR 38.841 CA\_n2-n77.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B116%5D%20NR_PC2_SUL_CA_lowMSD/Round%202/Rev%20R4-2203829%20TP%20for%20TR%2038.841%20CA_n2-n77.docx) |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2203830 | TP for TR 38.841: CA\_n66-n77 |
| [Verizon] The Tdoc can be noted as a duplication of R4-2205930. |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2205726 | TP for TR 38.841 to add CA\_n7-n78 |
| [Ericsson]: Comments made during 1st round are corrected in [revision 2 of R4-2205726 TP for TR 38.841 to add CA\_n7-n78](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B116%5D%20NR_PC2_SUL_CA_lowMSD/Round%202/revision%202%20of%20R4-2205726%20TP%20for%20TR%2038.841%20to%20add%20CA_n7-n78.docx) |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2205727 | TP for TR 38.841 to add CA\_n28-n78 |
| [Ericsson]: Comments made during 1st round are corrected in [revision of R4-2205727 TP for TR 38.841 to add CA\_n28-n78](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B116%5D%20NR_PC2_SUL_CA_lowMSD/Round%202/revision%20of%20R4-2205727%20TP%20for%20TR%2038.841%20to%20add%20CA_n28-n78.docx) |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2205928 | TP for TR38.841: PC2 and PC1.5 n77 for CA\_n25A-n77A |
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| Rev of R4-2205932 | Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n25 and n77 |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2205930 | TP for TR38.841: PC2 and PC1.5 n77 for CA\_n66A-n77A |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2205934 | Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n66 and n77 |
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# Topic #1: [9.32] NR\_UE\_PC2\_R17\_CADC\_SUL\_xBDL\_yBUL

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations/Abstracts** |
| [R4-2204018](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204018.zip) | AT&T | TP for TR 38.842 Addition of CA\_n2-n29-n77 |
| [R4-2204019](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204019.zip) | AT&T | TP for TR 38.842 Addition of CA\_n2-n66-n77 |
| [R4-2204020](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204020.zip) | AT&T | TP for TR 38.842 Addition of CA\_n5-n29-n77 |
| [R4-2204021](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204021.zip) | AT&T | TP for TR 38.842 Addition of CA\_n5-n66-n77 |
| [R4-2204022](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204022.zip) | AT&T | TP for TR 38.842 Addition of CA\_n29-n30-n77 |
| [R4-2204023](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204023.zip) | AT&T | TP for TR 38.842 Addition of CA\_n29-n66-n77 |
| [R4-2204024](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204024.zip) | AT&T | DraftCR 38.101-1 Addition of PC2 CA Combinations |
| [R4-2204218](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2204218.zip) | Qualcomm Incorporated | PC2 MSD NRCA 3DL 2UL for TR 38.842 |
| [R4-2205728](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205728.zip) | Ericsson, Telstra | TP for TR 38.842 to add CA\_n5-n7-n78 |
| [R4-2205729](file:///E:\01%20标准\14%20HPUE\02%20UL_interCA\202202RAN4_102_e\Docs\R4-2205729.zip) | Ericsson, Telstra | TP for TR 38.842 to add CA\_n7-n28-n78 |

## Open issues summary

### Sub-topic 2-1: MSD NRCA 3DL 2UL for CA\_n5-n7-n78, CA\_n7-n28-n78 and fallbacks

**Proposal (R4-2204218):**

* CA\_n28-n78

For harmonic mixing, the n78 power has increased by 3dB, which results in 3dB more power down-converted at the 5th RX LO harmonic.

Table 2.1-1: Reference sensitivity exceptions due to harmonic mixing from a PC2 aggressor NR UL band for NR CA FR1 for PC2 CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **NR Band / Channel bandwidth of the affected DL band** | | | | | | | | | | | | | | |
| **UL band** | **DL band** | **5 MHz**  **(dB)** | **10 MHz**  **(dB)** | **15 MHz**  **(dB)** | **20 MHz**  **(dB)** | **25 MHz**  **(dB)** | **30**  **MHz(dB)** | **40 MHz**  **(dB)** | **50 MHz**  **(dB)** | **60 MHz**  **(dB)** | **70**  **MHz(dB)** | **80 MHz**  **(dB)** | **90 MHz**  **(dB)** | **100 MHz**  **(dB)** |
| n78 | n281 | **31** | **28** | **26.2** | **25** |  | **11.7** |  |  |  |  |  |  |  |
| NOTE 1: The requirements should be verified for DL EARFCN of the victim (lower) band (superscript LB) such that  with  the DL carrier frequency in the lower band and the UL carrier frequency in the higher band, both in MHz. | | | | | | | | | | | | | | |

Table 2.1-2: Uplink configuration for reference sensitivity exceptions due to receiver harmonic mixing for CA in NR FR1

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| **NR Band / SCS / Channel bandwidth of the affected DL band** | | | | | | | | | | | | | | | |
| **UL band** | **DL band** | **SCS**  **(kHz)** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30**  **MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70**  **MHz** | **80 MHz** | **90 MHz** | **100 MHz** |
| n78 | n28 | **15** | **25** | **50** | **75** | **100** |  | **160** |  |  |  |  |  |  |  |
| NOTE 1: The UL configuration applies regardless of the channel bandwidth of the UL band unless the UL resource blocks exceed that specified in Table 7.3.2-3 for the uplink bandwidth in which case the allocation according to Table 7.3.2-3 applies. | | | | | | | | | | | | | | | |

* CA\_n5-n7-n78

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5-n7-n78 | n5 | 834 | 5 | 25 | 879 | **35.2** | FDD | IMD2 |
| n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n78 | 3429 | 10 | 50 | 3429 | N/A | TDD | N/A |
| n5 | 830 | 5 | 25 | 875 | **15.6** | FDD | IMD5 |
| n7 | 2525 | 5 | 25 | 2645 | N/A | FDD | N/A |
| n78 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
| n5 | 844 | 5 | 25 | 889 | N/A | FDD | N/A |
| n7 | 2525 | 5 | 25 | 2645 | **35.1** | FDD | IMD2 |
| n78 | 3489 | 10 | 50 | 3489 | N/A | TDD | N/A |
| n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
| n7 | 2540 | 5 | 25 | 2660 | N/A | FDD | N/A |
| n78 | 3375 | 10 | 50 | 3375 | **34.7** | TDD | IMD2 |
| n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
| n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n78 | 3430 | 10 | 50 | 3430 | **20.4** | TDD | IMD4 |
| NOTE 1: | | | | | | | | |

* CA\_n7-n28-n78

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n7-n28-n78 | n7 | 2567.5 | 5 | 25 | 2687.5 | N/A | FDD | N/A |
| n28 | 727.5 | 5 | 25 | 782.5 | **33.8** | FDD | IMD2 |
| n78 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
| n7 | 2567.5 | 5 | 25 | 2687.5 | N/A | FDD | N/A |
| n28 | 727.5 | 5 | 25 | 782.5 | **15.0** | FDD | IMD5 |
| n78 | 3460 | 10 | 50 | 3460 | N/A | TDD | N/A |
| n7 | 2530 | 5 | 25 | 2650 | **35.5** | FDD | IMD2 |
| n28 | 740 | 5 | 25 | 795 | N/A | FDD | N/A |
| n78 | 3390 | 10 | 50 | 3390 | N/A | TDD | N/A |
| n7 | 2565 | 5 | 25 | 2685 | N/A | FDD | N/A |
| n28 | 745 | 5 | 25 | 800 | N/A | FDD | N/A |
| n78 | 3310 | 10 | 50 | 3310 | **34.7** | TDD | IMD2 |
| n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n28 | 720 | 5 | 25 | 775 | N/A | FDD | N/A |
| n78 | 3714 | 10 | 50 | 3714 | **20.4** | TDD | IMD4 |
| NOTE 1: | | | | | | | | |

**Recommended WF:**

* The proposed values have been reflected in the corresponding TPs in sub-topic 1-2 for 2DL and 2-2 for 3DL. So this contribution R4-2204218 is recommended as noted. But it is open to collect the comments for these above MSD values derivation or proposals.

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| **Company** | **Comments on Sub-topic 2-1: MSD NRCA 3DL 2UL for CA\_n5-n7-n78, CA\_n7-n28-n78 and fallbacks** |
| Huawei | In the MSD calculation in Section 4, the same interference level for PRX and DRX is shown. Typically, there’s about 10 dB difference due to antenna isolation. Is it because some specific RF architecture is assumed or some other reasons? Could you please clarify? |
| Qualcomm | When the victim band is n78 and the other bands are below 2.6GHz, then the assumed architecture could be n7 and n28 on one antenna and n78 on the other antenna, so interference levels should be the same in those cases.  When PCB coupling dominates for victim bands n7 or n28 where the primary receiver is paired with the transmitter, the IMD at both RX ports will be the same when the levels are referred to the antenna. On the other hand, when the conducted path dominates, then there could be a 10dB difference or a value between 0-10dB depending on the severity of PCB coupling.  Since the PC3 MSD was already agreed and evaluated, we simply chose the worst-case scenario to evaluate the PC2 MSD, which assumes equal interference levels based on the measured IMD delta.  If Huawei thinks the PC2 MSD is over-estimated, then 10dB difference can be used for the MSD values, and slightly lower values can be used. We are open to that slight reduction. |
| Huawei | We’re fine with Qualcomm’s clarification. Since the potential difference might be small, there’s no need to change. |
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### Sub-topic 2-2: [3DL/2UL]TPs/draft CRs to introduce UE requirements for combos

**Proposed CRs/TP:**

* R4-2204018 TP for TR 38.842 Addition of CA\_n2-n29-n77
* R4-2204019 TP for TR 38.842 Addition of CA\_n2-n66-n77
* R4-2204020 TP for TR 38.842 Addition of CA\_n5-n29-n77
* R4-2204021 TP for TR 38.842 Addition of CA\_n5-n66-n77
* R4-2204022 TP for TR 38.842 Addition of CA\_n29-n30-n77
* R4-2204023 TP for TR 38.842 Addition of CA\_n29-n66-n77
* R4-2204024 DraftCR 38.101-1 Addition of PC2 CA Combinations
* R4-2205728 TP for TR 38.842 to add CA\_n5-n7-n78
* R4-2205729 TP for TR 38.842 to add CA\_n7-n28-n78

**Recommended WF:**

* Collect the comments for proposed TP and draft CRs. If no comments for certain of TP or draft CR, the TP or draft CR will be recommended as approved.

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| **CR/TP number** | **Comments collection for Sub-topic 2-2: [3DL/2UL]TPs/draft CRs to introduce UE requirements for combos** |
| R4-2204018 |  |
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| R4-2204019 |  |
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| R4-2204020 |  |
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| R4-2204021 |  |
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| R4-2204024 |  |
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| R4-2205728 | Huawei: Please wait for the clarification of sub-topic 2-1. This applies to all TPs that depend on the MSD analysis in R4-2204218.  And for MSD test points, the convention seems to be: if MSD for IMD2/3 is defined, no need to define MSD for IMD4/5 for the same victim band. This applies to all TPs. |
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| R4-2205729 |  |
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## 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 2-2: [3DL/2UL]TPs/draft CRs to introduce UE requirements for combos | **Recommended WF:**   * R4-2204018 TP for TR 38.842 Addition of CA\_n2-n29-n77 is recommended as approved * R4-2204019 TP for TR 38.842 Addition of CA\_n2-n66-n77 is recommended as revised * R4-2204020 TP for TR 38.842 Addition of CA\_n5-n29-n77 is recommended as approved * R4-2204021 TP for TR 38.842 Addition of CA\_n5-n66-n77 is recommended as approved * R4-2204022 TP for TR 38.842 Addition of CA\_n29-n30-n77 is recommended as approved * R4-2204023 TP for TR 38.842 Addition of CA\_n29-n66-n77 is recommended as approved * R4-2204024 DraftCR 38.101-1 Addition of PC2 CA Combinations is recommended as endorsed * R4-2205728 TP for TR 38.842 to add CA\_n5-n7-n78 is recommended as revised * R4-2205729 TP for TR 38.842 to add CA\_n7-n28-n78 is recommended as revised |

## Discussion on 2nd round

### Sub-topic 2-2(2nd round): [3DL/2UL]TPs/draft CRs to introduce UE requirements for combos

**Recommended WF**: Continue discuss the revised TPs/draft CRs.

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| **CR/TP number** | **Comments collection for 2.4.1 Sub-topic 2-2(2nd round): [3DL/2UL]TPs/draft CRs to introduce UE requirements for combos** |
| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2204019 | TP for TR 38.842 Addition of CA\_n2-n66-n77 |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2205728 | TP for TR 38.842 to add CA\_n5-n7-n78 |
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| [Rev](file:///E:\\01%20标准\\14%20HPUE\\02%20UL_interCA\\RAN4_101b_e\\Docs\\R4-2201680.zip) of R4-2205729 | TP for TR 38.842 to add CA\_n7-n28-n78 |
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# Recommendations for Tdocs

## 1st round

### 9.30 High power UE (power class 2) for NR inter-band Carrier Aggregation with 2 bands downlink and 2 bands uplink

**New tdoc**

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|  | **Title** | **Source** | **Comments** |
| #1 | Revised WID: High power UE for NR inter-band Carrier Aggregation with 2 bands downlink and x bands uplink (x =1,2) | China Telecom | There are new combos request in the reflector. |

**Existing tdocs**

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| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2203631 | Draft CR to 38.101-1 Correct the descriptions on power class requirements applications for UE maximum output power for CA | China Telecom | Revised | No further comments to latest rev shared, the draft revision is recommended as agreeable. |
| R4-2203829 | TP for TR 38.841: CA\_n2-n77 | Verizon | Revised |  |
| R4-2203830 | TP for TR 38.841: CA\_n66-n77 | Verizon | Revised |  |
| R4-2205725 | TP for TR 38.841 to add CA\_n5-n78 | Ericsson, Telstra | Approved |  |
| R4-2205726 | TP for TR 38.841 to add CA\_n7-n78 | Ericsson, Telstra | Revised |  |
| R4-2205727 | TP for TR 38.841 to add CA\_n28-n78 | Ericsson, Telstra | Revised |  |
| R4-2205927 | Draft CR for 38.101-1: Corrections related to PC2 and PC1.5 with DL CA | T-Mobile USA, Interdigital, Skyworks Solutions, Inc | Revised | No further comments to latest rev shared, the draft revision is recommended as agreeable. |
| R4-2205928 | TP for TR38.841: PC2 and PC1.5 n77 for CA\_n25A-n77A | T-Mobile USA | Revised |  |
| R4-2205929 | TP for TR38.841: PC2 and PC1.5 n77 for CA\_n41A-n77A | T-Mobile USA | Approved |  |
| R4-2205930 | TP for TR38.841: PC2 and PC1.5 n77 for CA\_n66A-n77A | T-Mobile USA | Revised |  |
| R4-2205931 | TP for TR38.841: PC1.5 n77 for CA\_n71A-n77A | T-Mobile USA | Approved |  |
| R4-2205932 | Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n25 and n77 | T-Mobile USA | Revised |  |
| R4-2205933 | Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n41 and n77 | T-Mobile USA | Endorsed |  |
| R4-2205934 | Draft CR for 38.101-1: Addition of PC2 and PC1.5 for combinations with n66 and n77 | T-Mobile USA | Revised |  |
| R4-2205935 | Draft CR for 38.101-1: Addition of n77 PC1.5 for DL CA\_n71A-n77A | T-Mobile USA | Endorsed |  |

### 9.32 Power Class 2 UE for NR inter-band CA and SUL configurations with x (x>2) bands DL and y (y=1, 2) bands UL

**Existing tdocs**

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| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2204018 | TP for TR 38.842 Addition of CA\_n2-n29-n77 | AT&T | Approved |  |
| R4-2204019 | TP for TR 38.842 Addition of CA\_n2-n66-n77 | AT&T | Revised |  |
| R4-2204020 | TP for TR 38.842 Addition of CA\_n5-n29-n77 | AT&T | Approved |  |
| R4-2204021 | TP for TR 38.842 Addition of CA\_n5-n66-n77 | AT&T | Approved |  |
| R4-2204022 | TP for TR 38.842 Addition of CA\_n29-n30-n77 | AT&T | Approved |  |
| R4-2204023 | TP for TR 38.842 Addition of CA\_n29-n66-n77 | AT&T | Approved |  |
| R4-2204024 | DraftCR 38.101-1 Addition of PC2 CA Combinations | AT&T | Endorsed |  |
| R4-2204218 | PC2 MSD NRCA 3DL 2UL for TR 38.842 | Qualcomm Incorporated | Noted |  |
| R4-2205728 | TP for TR 38.842 to add CA\_n5-n7-n78 | Ericsson, Telstra | Revised |  |
| R4-2205729 | TP for TR 38.842 to add CA\_n7-n28-n78 | Ericsson, Telstra | Revised |  |

## 2nd round