**3GPP TSG-RAN WG4 Meeting #102-e R4-220xxxx**

**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. |
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| [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. |
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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. |
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| 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. |
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| R4-2205725 |  |
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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. |
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| 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. |
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| R4-2205928 R4-2205932 |  |
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| R4-2205930 R4-2205934 |  |
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| R4-2205931 R4-2205935 |  |
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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** |
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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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# Recommendations for Tdocs

## 1st round

## 2nd round