**3GPP TSG-RAN WG4 Meeting # 97-e R4-201xxxx**

**Electronic Meeting, 2-13 Nov., 2020**

**Agenda item:** 10.19

**Source:** Moderator (China Telecom)

**Title:** Email discussion summary for [97e][122] NR\_PC2\_CA\_R17\_2BDL\_2BUL

**Document for:** Information

# Introduction

This email discussion thread is related to NR PC2 CA basket WI, and will focus on the topic of following aspects:

* Topic #1: Work plan, TR skeleton and revised WID
* Topic#2: UE RF requirements
	+ Issue 2-1-1: MSD for n77 PC2 combos
	+ Issue 2-1-2: TPs for approval

Note that the table for filling comments is assigned just at the bottom of each section of issues.... But the table for collecting comments for CR/TP is still kept in the original position.

# Topic #1: Work plan, TR skeleton and revised WID

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations/Abstracts** |
| [R4-2015186](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015186.zip) | China Telecom | **Abstract**:This contribution provides the work plan for the WI. |
| [R4-2015187](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015187.zip) | China Telecom | **Abstract**:This contribution provides the TR skeleton v0.0.1. |
| [R4-2015188](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015188.zip) | China Telecom | **Abstract**:This contribution provides the draft TR v0.1.0, which was reserved for email approval and aims to reflect the TP approved in this meeting. |
| [R4-2015189](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015189.zip) | China Telecom | **Abstract**:revised WI to capture comments and new request from RAN4 reflector. |

## Open issues summary

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

### Sub-topic 1-1: Work plan, TR skeleton and revised WID

This sub-topic will discuss rapporteur input for work plan, TR skeleton and revised WID.

**Issue 1-1-1: Work plan**

* Recommended WF
	+ It is recommended to approve the work plan of R4-2015186

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| **Company** | **Comments** |
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**Issue 1-1-2: TR skeleton**

* Recommended WF
	+ It is recommended to approve the TR skeleton of R4-2015187

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| **Company** | **Comments** |
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**Issue 1-1-3: Revised WID**

* Summarization for the WID revision
	+ Add new objectives according to comments. The new objectives aims to specify requirements for 2band DL and 1band UL for both PC2 and PC1.5, which are the fallbacks of 2BDL/2BUL.
	+ Add new combos requests from operators by considering the new revised objectives.
* Recommended WF
	+ It is recommended to approve the new revised WID of R4-2015189

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| **Company** | **Comments** |
| Qualcomm | The WID revision includes PC1.5 UL CA band combinations. However, the PC1.5 WID that was recently completed only considered intra-band EN-DC, UL MIMO, and TxD. So UL CA has not been considered yet. Would this be a 3 simultaneous PA architecture with (26+26)+23? Is there anything that needs to be evaluated for this in a general sense before this gets put into a basket? |
| ZTE | Same concern with QC. Including PC1.5 will cause confusion due to the WID is for PC2. Also PC1.5 single carrier is achieved via dual Tx, means 3Tx to support UL CA. |
| CMCC | It is necessary to specify requirements for 2band DL and 1band UL as fallback of 2BDL/2BUL. |
| Huawei | PC1.5 needs further discussion to be added in the WI. If it was added, SAR discussion had to be facilitated with PC1.5 either. |
| China Telecom | We add PC1.5 for 2DL/1UL not 2UL in this WID, according to T-Mobile USA request and clarification in the reflector, which means only band combination requirements will be considered in this WID, rather than SAR issue. We are open to discuss.  |

## 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:*No comments on work plan and TR skeleton.*Candidate options:**Recommendations for 2nd round:* Further discussion on the revised WID. |

*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**  |
| [R4-2015186](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015186.zip) | Approved |
| [R4-2015187](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015187.zip) | Approved |
| [R4-2015188](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015188.zip) | for email approval |
| [R4-2015189](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015189.zip) | To be revised |

## Discussion on 2nd round (if applicable)

**Issue 1-1-3 (continual): Revised WID**

Concerns from companies: 2UL for PC1.5 shall be removed

Clarification from T-Mobile USA in Reflector: only 1UL for PC1.5 is cosidered.

Proposal: With above clarification, can we approve the revised WID R4-2015189?

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| **Company** | **Comments for issue 1-1-3 on 2nd round** |
| ZTE | Regarding the revised WID: As commented by CMCC in 1st round, the fallback mode should be specified for PC2 2BDL/2BUL. We also didn’t find such information in the WID. It is not clear whether the PC2 2BDL/1BUL and/or the corresponding NR PC3 NR CA is the fallback mode for PC2 2BDL/2BUL. We tend to agree with CMCC that PC2 2BDL/1BUL should be specfied as the fallback mode of PC2 2BDL/2BUL, like PC3 NR CA. Also, as we discussed in the last meeting, PC3 NR CA should be the pre-condition when proponent requesting the PC2 NR CA. It needs to include such information in the WID. In our view, without the above information, we don’t know how to judge whether a certain combiantion is ok or not. It may cause problem when proponent requesting their PC2 combination.In addition, we don’t think “configured transmitted power” needs to be studied for band combination, it is general requirement which is applicable for all the combinations. It is more proper to include it in SAR WID.For the title, the WID title is only for 2 bands uplink, which means the 1 band UL is excluded. We suggest to correct the WID title as ”High power UE(power class 2) for NR inter-band Carrier Aggregation with 2 bands downlink and x bands uplink (x=1,2) ”. Otherwise, 1UL combination cannot be included, which means all the new added 1UL band combiantions are not allowed but it seems cannot be acceptable by operator.For PC1.5:It doesn’t belong to PC2. Also it seems the SAR issue needs to be considered. |
| LGE | Similar view with ZTE, RAN4 do not need to study “configured transmitted power” for PC2 UE. And prefer as ”High power UE(power class 2) for NR inter-band Carrier Aggregation with 2 bands downlink and 2 bands uplink ”.Also, need to exclude PC1.5 discussion. |

## 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/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: UE RF requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations/Abstracts** |
| [R4-2015053](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015053.zip) | ZTE Corporation, CMCC | TP for TR38.xxx\_ PC2 CA\_n3A-n41A |
| [R4-2015054](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015054.zip) | ZTE Corporation, CMCC | TP for TR38.xxx\_ PC2 CA\_n28A-n41A |
| [R4-2015055](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015055.zip) | ZTE Corporation, CMCC | TP for TR38.xxx\_ PC2 CA\_n28A-n79A |
| [R4-2015056](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2015056.zip) | ZTE Corporation, CMCC | TP for TR38.xxx\_ PC2 CA\_n40A-n41A |
| [R4-2016441](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2016441.zip) | Qualcomm Incorporated | MSD values for PC2 UL CA for CA\_n2-n77, CA\_n5-n77, and CA\_n66-n77 are provided. Using more aggressive PCB isolation assumptions, it is demonstrated that the MSD can be signficantly improved making the combinations more suitable for operator deployment. Without these assumptions, the UE effectively cannot operate in a network under the condition of harmonic or 2UL IMD interference |

## Open issues summary

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

### Sub-topic 2-1: UE RF requirements

This sub-topic will discuss UE RF requirements for proposed combinations.

**Issue 2-1-1: MSD for n77 PC2 combos**

* Proposals ([R4-2016441](file:///E%3A%5C01%20%E6%A0%87%E5%87%86%5C14%20HPUE%5C02%20UL_interCA%5CRAN4_97_e%5CDocs%5CR4-2016441.zip))
	+ Moderator understands this contribution proposed to use more aggressive assumptions for PC2 MSD calculation; otherwise the conventional assumptions based requirements are too poor to be useful for deployment.
* Recommended WF
	+ Collect views on this discussion paper
	+ If a WF or some agreements are necessary to align the new assumptions

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| **Company** | **Comments** |
| Verizon:  | We support this type of discussions because the content of contribution provides a new method with assumptions to lower down the possible MSD values significantly. Without these new assumptions, the UE effectively cannot operate in a network under the condition of harmonic or 2UL IMD interference. RAN4 should adopt the new assumptions in future NR CA and EN-DC works. |
| LGE | We think the 90dB PCB isolation is just derive to reduce MSD level for PC2 DC/CA UE.In commercial UE, the 90dB isolation level is not possible to achieve the level in small UE form factor. Also NSA UE shall support both LTE and NR variable DC/CA band combinations at least 10 different operating bands. We are fine to revise simulation assumptions to derive MSD level for HPUE in Rel-17. However, RAN4 should consider reasonable PCB isolation level and commercial RF component performance. |
| CHTTL: | We share the similar view as Verizon.And we think if the new assumption is agreed, then it should apply to all the UL NR CA and also EN-DC PC2 combination. |
| OPPO | In our understanding, the specification were defined based on the state of art UE design rather from making the requirements look better perspective. If the PCB isolation can be improved so much in commercial UE then we are fine to consider it, but this needs implementation justification.Another point is that if this is difficult for smart phone, maybe can consider for large form factor UE like CPE? |
| Qualcomm | PCB isolation is never written as a requirement in the specification and it is not our intention to do that. It is only used as a parameter to derive MSD. From our understanding, real commerical small handheld phones are able to achieve MSD values that are comparable to ~90 dB isolation. This is not to say that the device actually achieves 90 dB isolation since there are other factors also to determine MSD. However, real devices can achieve this level of MSD performance so the specs should be written to more closely reflect this. |
| ZTE | A full picture of the new assumption for all the parameters may be needed due to except for the more aggressive PCB isolation, we wonder if there are other parameters (IPx (dBm)(x=2,3,4,5) )have more aggressive values?Also, how to treat the existing MSD of PC3? It can be foreseen that the PC2 MSD with more aggressive assumption will be better than PC3 which may cause confusion if the more aggressive assumptions are not included in the spec.Actually there are several RF components which will cause intermodulation, such as antenna switch, diplexer/triplexer, duplexer, filter, PA etc, sometimes dominated IMD products caused by antenna switch, duplexer or diplexer, and sometime dominated IMD products caused by PA, depending on different intermodulation types. It seems the better PCB isolation(~90dB) can only improve the IMD caused by PA but no effect on the IMD caused by antenna switch, diplexer/triplexer or diplexer. Moreover, when discussing the MSD for LTE, if my memory is correct, the higher PCB isolation design is bottleneck means better PCB isolation may not easy to be achieved. Consequently, 60~70dB PCS isolation is used at that time.For the proposal, we understand the intention, indeed high MSD values are not attractive by operator. So improving the MSD value is feasible. However, except for PCB isolation, we wonder if there is possible that more aggressive assumptions for the other component RF parameters such as IPx (dBm)(x=2,3,4,5) for antenna switch, diplexer, duplexer, triplexer, PA, except for PCB isolation. |
| Xiaomi | As commented in Email thread 123, MSD value is not directly used for BS deciding whether the band combination could be configurable or not in real deployment. In our view, the decisions for BS scheduling depends on actually channel quality not the MSD. Moreover, the MSD value in current spec is just the minimum requirements, which doesn’t preclude any UEs with better MSD.The proposed improving MSD for PC2 is even 10dB smaller than that for PC3 for some band combination. This is difficult to do by smart phone. |
| China Telecom | We share the same view as Verizon and CHTTL.We suggest to improve the general assumptions for MSD analysis, otherwise the MSD value is too larger and less meaningful for reference when deployment. |

**Issue 2-1-2: TPs for approval**

* Proposed TPs
	+ R4-2015053, 15054, 15055, 15056
* Recommended WF
	+ Collect the comments for proposed TPs in the section 2.3.1. If no comments for certain of TP, the TP will be recommended as approved in the summary for 1st round.

## Companies views’ collection for 1st round

### CRs/TPs comments collection

The following table aims to collect the comments for proposed TPs. If no comments for certain of TP, the TP will be recommended as approved in the summary for 1st round.

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2015053 | CHTTL: The term “EN-DC” and “DC\_n3A\_n41A” are still used in Table 5.x.3.2-1 and Table 5.x.3.2-2, better to fix them? |
| ZTE: we can fix it in the revision. |
| Huawei: To be safe, put 2.3dB in brackets since it seems a bit stringent. |
| R4-2015054 |  |
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| R4-2015055 |  |
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| R4-2015056 |  |
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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** | *Tentative agreements:*For Issue 2-1-1: MSD for n77 PC2 combos* a WF is proposed for MSD assumptions improvement

For Issue 2-1-2: TPs for approval* R4-2015053 needs to be revised based on comments
* No comments on 15054, 15055, 15056

*Candidate options:**Recommendations for 2nd round:* Discussion on the WF for MSD improvement |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | WF on MSD assumptions improvement for UE PC2 combinations | [China Telecom] |

### 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**  |
| R4-2015053 | To be revised to |
| R4-2015054 | approved |
| R4-2015055 | approved |
| R4-2015056 | approved |

## Discussion on 2nd round (if applicable)

### Sub-topic 2-1: UE RF requirements

**Issue 2-1-1: MSD for n77 PC2 combos**

This issue was captured in a WF. The informantion and recommended email thread for the WF discussion are shown in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **WF** | **Tdoc number assigned** | **WF/LS t-doc Title**  | **Email thread recommended** | **Assigned Company,****WF lead** |
| #1 | R4-2016854 | WF on MSD assumptions improvement for UE PC2 combinations | [97e][122] NR\_PC2\_CA\_R17\_2BDL\_2BUL -WF-R4-2016854 | China Telecom |

This table below will collect the comments for the WF of R4-2016854. Moderator will copy the comments from email thread and paste into this table during summarizing the 2nd round discussion for well tracing the history.

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| --- | --- |
| **Company** | **Comments for MSD assumptions improvement in WF-R4-2016854** |
| OPPO | Some improvement from our side are as below. The reason is that in the paper R4-2016441 and also the 1st page of WF it is clear that this MSD improvement is for the sake of reflecting good commercial UE ability to make the MSD meaningful for deployment. We are also support of this direction efforts, and think the good commercial UE ability should be considered in RAN4. Therefore, we suggest in the following discussions this improved MSD performance ability should base on commercial UE ability to make it close to the real products.cid:image003.jpg@01D6B783.C7FA8090 |
| LGE | RAN4 need to study which PCB isolation is achievable level. Also can be further discuss on the other facts to improved MSD level for PC2.However, the proposed WF is focus on [90dB] PCB isolation level. As I mentioned in 1st round, the PCB isolation should be considered the reasonable range from UE venders as same LTE-A CA and NR DC band combinations. However, you ignore these performance in current stage. It should be discussed based on Vendor’s achievable levels, firstly.So, LGE strongly concern the WF to improve MSD level with slide3 for PC2 UE. Also, do not need to specify separate MSD levels with different capability. |
| Xiaomi | We understand the intention, but how much the MSD can be improved should be based on the reasonable assumption from actual UE implementation point of view especially considering more bands and band combinations would be supported in NR compared to LTE.Besides, how this capability would be used for BS may also need to be clarified since in our view, the MSD is not directly used for BS deciding whether the band combination could be configurable or not in real deployment. |
| Nokia | We support this idea from QC. In terms of specification, this does not force all the UEs to meet better MSD values for every single band combination. This makes both UE and NW happier. If we did not introduce this capability, the UE with better performance would not be able to get opportunity to make maximum use of its ability, since network may not operate such band combination or even if the NW operates with the band combination, the scheduling must be very conservative. For instance, the UE which has improved MSD is only configured with the band combination when UL power is significantly lower and/or DL signal power is significant higher because network cannot distinguish good UE from band UE. |
| Verizon | We support this WF and support the Qualcomm contributions. The MSD requirement is an important factor for the network planning, in which the standardized requirements will be firstly evaluated in the decision whether the band combination will be deployed or not. For meeting this, additional optimizations happened in the implementations. In fact the devices can be able to deliver very low MSD values practically in comparing the specified MSD values, and the implemented low MSD values have been significantly improved making the combinations to suitable the real deployments. The existing MSD without these improvements cannot be operated in networks. Also, the differences of the both specified MSD ranges and the implemented MSD values are very large. Therefore, the new assumptions from Qualcomm for the MSD in requirements to both ENDC and NR CA PC2 UE are essential. RAN4 should accept the assumptions as a baseline for the enhancement. Also, we are interested in all of the other factors pointed out by companies, RAN4 should discuss and identify these requirements further as part of this WF too. |
| Qualcomm | One common theme from handset vendors is that the assumptions should reflect practically achievable performance from commercial designs. We think this is a reasonable request, but also remind that since this is indicated by capability signaling, it is not necessary that ALL UE’s can meet these requirements. It is understood that due to various tradeoffs, some UE’s will not be able to signal this capability. We suggest modifying the WF to include a bullet inviting companies to bring in MSD measurements on commercial or near-commercial devices so that we can evaluate what is feasible with commercial handsets. We suggest that Band 3 + Band n78 might be a good example since we are aware that several handsets support this combination. |

**Issue 2-1-2: TPs for approval**

The table in 2.5.2 will collect the comments for revised TPs. Please the TP proponents make the revision available as soon in order to be reviewed by the companies who commented on 1st round.

The Open issues

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2015053 -> R4-2016855 |  |
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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/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |