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

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

**Agenda item:** 10.20

**Source:** Moderator (China Unicom)

**Title:** Email discussion summary for [97e] [123] ENDC\_UE\_PC2\_R17\_NR\_TDD

**Document for:** Information

# Introduction

This summary discusses the Rel-17 WI of High Power UE (Power Class 2) for EN-DC with 1 LTE band + 1 NR TDD band.

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: Confirming and agreeing the content of TR skeleton and TPs, as well as determining the release-independent issue for this WI.
* 2nd round: TBA

# Topic #1: PC2 for EN-DC

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014649 | China Unicom | TR Skeleton for TR 37.826 |
| R4-2014679 | China Unicom | TP for TR 37.826 to introduce PC2 for DC\_1A\_n78A |
| R4-2014680 | China Unicom | TP for TR 37.826 to introduce PC2 for DC\_8A\_n78A |

## 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: TR Skeleton

* Recommended WF
  + It is recommended to approve the TR Skeleton R4-2014649

### Sub-topic 1-2: TP for TR 37.826

* Recommended WF
  + It is recommended to approve TP R4-2014679 and R4-2014680

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Sub topic 1-1: Agree with moderator’s recommendation  Sub topic 1-2: Agree with moderator’s recommendation  ….  Others: |
| Xiaomi | Sub topic 1-1: Agree with moderator’s recommendation  Sub topic 1-2: Agree with moderator’s recommendation. The proposed MSD values seems reasonable for us.  ….  Others: |
| CHTTL | Subtopic 1-2:  R4-2014679 & R4-2014680:  - One minor comment that the UL LCRB for 10MHz n78 should be 50 RB in the MSD table. |
| Qualcomm | Sub-topic 1-2: Are the assumptions and details of the analysis available for these MSD proposals? There seems to be a difference in the MSD between UL CA and EN-DC for the same combination. What is the reason? |
| China Unicom | Thanks for careful checking, we propose to revise the values for UL LCRB for 10MHz n78 to 50RB in the TP. For the MSD value, after some offline discussions with the proponent of PC2 UL CA for n1+n78, we propose to update the MSD value form 17.4dB to 17.8dB for alignment between EN-DC and UL CA. |
| Huawei, HiSilicon | Sub topic 1-1: Agree with moderator’s recommendation  Sub topic 1-2: OK with the modified MSD by China Unicom. |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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** |
| **Sub-topic#1 TR Skeleton** | *Tentative agreements: TR Skeleton is agreeable*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2 TP for TR 37.826** | *Tentative agreements: Value of UL LCRB for 10MHz n78 is 50RB, MSD value for DC\_1A-n78A is 17.8dB for alignment between EN-DC and UL CA for the same combination*  *Candidate options:*  *Recommendations for 2nd round: Agree on revised TP and big CR on introducing PC2 for DC\_1A-n78A and DC\_8A-n78A.* |

*Recommendations 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 provides recommendation on CRs/TPs Status update*

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2014649 | *TR Skeleton is agreeable.* |
| R4-2014679 | *TP for TR 37.826 to introduce PC2 for DC\_1A\_n78A is to be revised.* |
| R4-2014680 | *TP for TR 37.826 to introduce PC2 for DC\_8A\_n78A is to be revised.* |

## Discussion on 2nd round (if applicable)

Comments are collected based on draft version of CR R4-2014708 and TP R4-2016856/R4-2016857 uploaded to the draft folder [97e][123] ENDC\_UE\_PC2\_R17\_NR\_TDD.

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2014708 | Company A |
| Company B |
|  |
| R4-2016856 | Company A |
| Company B |
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| R4-2016857 | Company A |
| Company B |
|  |

## 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/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: General Issues

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015793 | CHTTL | Proposal 1: The power class 2 of 1 LTE FDD band and 1 NR TDD band EN-DC is release independent from Rel.15.  Proposal 2: The changes for TS 38.307 will be based on the changes in section 5. |
| R4-2016440 | Qualcomm | Proposal 1: For PC2 band combinations where harmonic, harmonic mixing, and/or 2UL IMD MSD exceeds [10] dB with conventional assumptions, a second MSD shall also be defined using more aggressive assumptions such as filter rejection and PCB isolation of 90 dB or better. The UE reports which MSD it complies with. |

## 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: Release-Independent Issue

*Sub-topic description: Discussion on release-independent issue for this basket WI. Companies are encouraged to provide comments on the attached draftCR in R4-2015793.*

*Open issues and candidate options before e-meeting:*

* Proposals: The power class 2 of 1 LTE FDD band and 1 NR TDD band EN-DC is release independent from Rel.15
* Recommended WF
  + TBA

### Sub-topic 2-2: MSD for PC2 Combinations

*Sub-topic description: Discussion on improving PC2 MSD for EN-DC and UL CA. The contribution (R4-2016440) is submitted for discussion.*

*Open issues and candidate options before e-meeting:*

* Proposals: It is proposed that a second MSD shall also be defined using more aggressive assumptions for UL CA and EN-DC PC2 combinations.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Sub topic 2-1: In our understanding, so far duty cycle signaling for PC2 ENDC are not supported in Rel-15, if it is release independent from Rel-15, that’s means the duty cycle scheme will not be used for Rel-15 UE although it is optional scheme. In other words, only P-MPR is used for PC2 UE in Rel-15. If that’s the common understanding, then we are fine with the proposal.  Sub topic 2-2: 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.  ….  Others: |
| Verizon | Sub topic 2-2:  Indeed, we support this Qualcomm proposal, as well as all of the other possible efforts, to lower down the MSD values and enhance the performance requirements. If it is correct, this Qualcomm contribution, in yearly RAN4 works, first time provides a new method to both industry and operator for the qualified MSD values. We expect other more aggressive assumptions to enhance the other RF parameters too.  In our view, RAN4 should accept the Qualcomm new assumptions directly to all of the RAN4 the PC2 band combination requirements as the only mothed from this time and without [10] dB with conventional assumptions if it is possible. |
| LGE | Sub topic 2-1: Release-Independent Issue  PC2 FDD+TDD DC combinations are studied and specified in Rel-16. Furthermore the solution to satisfy SAR regulation was specified in Rel-16. So we prefer PC2 FDD+TDD DC band combinations will be applied from Rel-16.  Sub topic 2-2: MSD for PC2 Combinations  In LTE CA, RAN4 already discussed the PCB isolation to use reasonable isolation level such as 60dB to derive MSD issue by harmonic/ intermodulation product. So the 55~65 dB PCB isolation shall be considered in HPUE DC combinations.  The 90dB PCB isolation is quite difficult to achieve in current small UE form factor to support PC2 DC combination. Also 5G NR smart phone shall support both LTE and NR with variable DC/CA band combinations. From the situation, 90dB isolation is quite aggressive level in UE vendor perspective. |
| Xiaomi | Sub topic 2-1: we are fine with the proposal. Same as release independent manner for NSA TDD+TDD  Sub topic 2-2: we think MSD value is just for testing. It will not directly used for BS deciding whether the band combination could be configurable or not in real deployment. The MSD value in current spec is just the minimum requirements, which doesn’t preclude any UEs with better MSD. In this case, We don’t think this second MSD requirement is necessary. |
| CHTTL | Sub topic 2-1: to ZTE, Yes, we have the same understanding as you, the PC2 FDD+TDD EN-DC can be release independent from Rel.15 with consideration when the duty cycle signalling is absent, i.e. the P-MPR solution. Regarding this topic, we would like to gather more companies’ view.  Note that in the current spec the PC2 TDD-TDD EN-DC is release independent from Rel.15.  Sub topic 2-2:  Share the same view as Verizon. |
| Qualcomm | Sub-topic 2-2:  For ZTE, yes there are other factors that also impact MSD. However, if you carefully study the analysis, you will realize that the PCB isolation is the dominant factor for the MSD values that we have specified in 3GPP. The linearity of the front-end passives is much better than the isolation across the PCB that has been assumed. We do agree that once the PCB isolation is improved to ~90 dB, then the other components can also start to play a bigger role. When we studied this for LTE, Qualcomm did express concern that high PCB isolation could not be achieved. And we still believe that may be the case for some phone designs. However, we have observed actual commercial phones that are able to deliver very low MSD values (near zero) when the 3GPP specified value is >20 dB. So it is evident that it is possible to achieve. Since not all phones may be able to do it, then we suggest capability signaling with two values – one conventional and one aggressive.  For LGE, same comment as above. We agree that 90 dB PCB isolation is aggressive, but we have observed that it is achievable. It makes a huge impact on the usability of the UE in that band combination.  For Xiaomi, according to operator feedback that we received, the MSD value is used in planning the network and even in deciding whether the band combination will be deployed. So it is not just a testing requirement to our understanding. |
| OPPO | Sub topic 2-2:  The PCB isolation assumption in Rel-15 is a typical value for smart phone, and it was used to define the minimum requirements in RAN4. It is well known that RAN4 requirements does not exclude UEs can do better in implementation. It is not clear the intention/benefit of introducing this capability. In real NW there will be UEs with relatively better or worse performance, but they all meet 3GPP requirements. It is not obvious that NW will use the MSD in RAN4 to decide whether the band combinations will be deployed or not even with the capability. Better understanding is needed for the capability. Maybe it can be defined for other UE types without form factor limitation like CPE. |
| China Unicom | Sub topic 2-1:  In our understanding, the PC2 feature for FDD+TDD EN-DC could be supported from Rel-15 by UE-based (e.g. P-MPR) method, even though the duty cycle capability reporting are supported from Rel-16. So we support the proposal that this feature is release independent from Rel-15. |
| Huawei, HiSilicon | Sub topic 2-1:  Since P-MPR is the baseline for UE implementation, HPUE EN-DC can be supported from Rel-15.  Sub topic 2-2:  Disagree with the proposal. There are different mechanisms to cause MSD, and in the specification, we have harmonic, harmonic mixing, IMD, cross band, proximity MSDs, PCB isolation is just one factor to calculate the MSD value, especially for the IMD MSD. Similar discussion also happens for other parameters, e.g. antenna isolation, in Rel-15 or even earlier release. However, no conclusion in the end. The common understanding is what specified in RAN4 are the minimum requirements, it does not exclude UE can have better implementation. If 90dB PCB isolation is achievable, why we need to discuss the cross talk noise caused by isolation issue for MIMO EVM in other agenda? On the other hand, if the band combinations do have the serious IMD MSD issue, single UL is also a valid method to solve the issue, and it was almost discussed one year in Rel-15 to have a complete solution. |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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 Release-Independent Issue** | *Tentative agreements: FDD+TDD EN-DC PC2 feature is release independent from Rel-15.*  *Candidate options:*  *Recommendations for 2nd round: Agree on the CR that FDD+TDD EN-DC PC2 feature is release-independent from Rel-15.* |
| **Sub-topic#2 MSD for PC2 Combinations** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Companies could further discuss their views on MSD for PC2 EN-DC and UL CA combinations.* |

*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** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

2.5.1 Comments on CR of Release independence of FDD-TDD EN-DC High Power UE

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| **CR/TP number** | **Comments collection** |
| R4-2016987 | CHTTL: The draft version is available in the below link:  https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_97\_e/Inbox/Drafts/%5B97e%5D%5B123%5D%20ENDC\_UE\_PC2\_R17\_NR\_TDD/draft%20of%20R4-2016987%20-%20CR%20for%20FDD-TDD%20PC2%20release%20independent%20v0.docx  The content is based on the moderator’s suggestion. With the clarification in the first round, we hope it can be agreed. |
| Company B |
|  |

2.5.2 Comments on MSD for PC2 Combinations

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| --- | --- |
| **Company** | **Comments** |
| LGE | Sub topic 2-2: MSD for PC2 Combinations  WF on MSD assumptions improvement for UE PC2 combinations (R4-2016854) will be discussed in [122] e-mail thread. In here, we can further discuss this topic. And follow the principle if RAN4 make some consensus in the WF.  Others: |
| Verizon | The draft WF from China Telecom ( [R4-201xxxx WF on MSD assumptions improvement.pptx](https://urldefense.proofpoint.com/v2/url?u=https-3A__www.3gpp.org_ftp_tsg-5Fran_WG4-5FRadio_TSGR4-5F97-5Fe_Inbox_Drafts_-255B97e-255D-255B122-255D-2520NR-5FPC2-5FCA-5FR17-5F2BDL-5F2BUL_R4-2D201xxxx-2520WF-2520on-2520MSD-2520assumptions-2520improvement.pptx&d=DwMFaQ&c=udBTRvFvXC5Dhqg7UHpJlPps3mZ3LRxpb6__0PomBTQ&r=gkdaVlH8E3iGHLmRXXVtiC55Bbz7gRQAVNzBMlgDC-c&m=bfC683CzELpSm4n6WZCMevfjOIfys_NauzmoZTt7pIA&s=iGdrzZdT7ywcDZNpaZBBYH5kiRlTzsfnb3Zc2u80nbM&e=" \t "_blank)) in the thread [122] should cover the MSD discussion in this group for the ENDC PC2. It would appreciate if both moderators could coordinate the WF discussions. Otherwise, we copy the same comments to here from the thread [122].  We support the draft WF from China Telecom 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 in 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. |
| Apple | Due to some upload error in the first round our comments were lost. Even as the discussion continuous in [122], we want to place our originally intended comments for reference:  Sub topic 2-1  We would prefer having it from Rel-17 onward. Still we think it is possible to have it release independent from Rel-15 but only if P-MPR is used as a solution. With Rel-16 we can use duty cycle based approach.  Sub topic 2-2:  We do not prefer to tighten the PCB isolation further and introduce of a second MSD based on the new assumption. Also, Introducing a capability signaling (for increased isolation assumption) will only complicate the case and the benefits for the network are not clear. |

## 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/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 #3: Description on UE feature list for FDD+TDD EN-DC Power Class 2

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015566 | Intel | Change of description for feature 2-20 in UE feature list. |

## 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 3-1 Description changes for UE feature on FDD+TDD EN-DC Power Class 2

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3-1:**

* The following changes in description were made in R4-2015566
* Description on ‘components’ is proposed as ‘The maximum percentage of symbols during a certain evaluation period that can be scheduled for NR uplink transmission and EUTRA FDD uplink transmission so as to ensure compliance with applicable electromagnetic energy absorption requirements provided by regulatory bodies for FDD+TDD EN-DC power class 2 UE.’
* Description on ‘Notes’ is proposed as ‘

Introduce 2 UE capabilities of *maxUplinkDutyCycle-FDD&TDD-EN-DC1* and *maxUplinkDutyCycle-FDD&TDD-EN-DC2* which indicate the maxUplinkDutyCycle capability of NR band corresponding to different LTE reference configurations as described in TS 38.101-3 clause 6.2B.1.3.

The value range is as below:

* *maxUplinkDutyCycle-FDD&TDD-EN-DC1, maxUplinkDutyCycle-FDD&TDD-EN-DC2 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%}*

This field is only applicable for inter-band FDD+TDD EN-DC power class 2 UE as specified in TS 38.101-3.

‘

* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 3-1: |
| OPPO | The description on ‘Notes’ is proposed as below, however, in our understanding, the maxUplinkdutycycle is one UE capability rather than two capabilities even though two reference LTE UL/DL configuration is defined.  “Introduce 2 UE capabilities of *maxUplinkDutyCycle-FDD&TDD-EN-DC1* and *maxUplinkDutyCycle-FDD&TDD-EN-DC2* which indicate the maxUplinkDutyCycle capability of NR band corresponding to different LTE reference configurations as described in TS 38.101-3 clause 6.2B.1.3.” |
| Intel | To OPPO: the updates capture latest agreements.  Two capabilities have been captured in approved CR R4-2011941. Also The LS R4-2011787 suggest to define 2 capabilities - maxUplinkDutyCycle-FDD&TDD-EN-DC1 and maxUplinkDutyCycle-FDD&TDD-EN-DC2.  Previous descriptions don’t reflect the CR and LS. |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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: Description on ‘components’ is agreeable.*  *Candidate options:*  *Recommendations for 2nd round: Companies can further discuss the proposed changes in ‘notes’ for 1 or 2 UE capabilities.* |

*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** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

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| --- | --- |
| **Company** | **Comments** |
| OPPO | Ok with the change. |

## 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/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”* |