**3GPP TSG-RAN WG4 Meeting # 96-e R4-200XXXX**

**Electronic Meeting, 17 – 28 Aug., 2020**

**Agenda item:** 4.2.3

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [96e][104] NR\_NewRAT\_UE\_RF\_Part\_3

**Document for:** Information

# Introduction

This email discussion handles the contributions submitted to agenda item 4.2.3, 4.2.3.1 and 4.2.3.3. The scope of this email discussion covers Rel-15 UE RF requirements maintenance on TS 38.101-3, which specifies the UE RF requirements for EN-DC operations. There are 3 topics (Rx, Tx and others) in this email discussion and multiple sub-topics within each of them. Note that since this discussion is mainly maintenance work we will start to agree on CRs and mirror CRs in the first round. In the second round only the contentious issues are discussed. There is no GTW time slot planned so far for this email discussion.

# Topic #1: Receiver requirements

Receiver requirements corrections are covered in Topic #1. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009663 | Anritsu | Discussion paper on EN-DC OoBB UE power setup:  Observation 1: Multi-RAT DC UEs have multiple capabilities of operation modes. Thus we need to create a common test assumption also taking these factors and applicable absolute UL power into account as well as the combination of duplex modes.  Observation 2: It is preferred that TRx RF requirements are defined as general as possible irrespective of any UE operation modes, UE design and duplex modes.  **Proposal 1:** Apply PCMAX\_L,c – 4 dB as UL power level for the source of IMD unless the assumed absolute UL power is changed.  **Proposal 2:** Choose the UL power level whose DL is being tested taking into account of the balance between the analysis of 2nd or 3rd order IMD impact for 2UL/2DL configuration and the TE dynamic range. (i.e. In between PCMAX\_L,c – 14 dB and PCMAX\_L,c – 29 dB.) |
| R4-2010045 | Apple | Discussion paper on EN-DC OoBB UE power setup:  Observation 1: OBB UL test configuration is generic to all EN-DC combinations irrespective of whether MSD is required and the MSD level. The UL power setting should be determined based on the worst-case MSD among all EN-DC combinations.  **Proposal:** Use (PCMAX\_L – 4dB, PCMAX\_L – 32dB) as the UL configuration for EN-DC OBB requirements.  Observation 2: The UL configuration for E-UTRA and NR 2UL inter-band CA OBB requirements as currently defined with both UL output power set to 7 dB below PCMAX\_L,f,c for each serving cell c is only applicable to CA combinations which do not have 2UL IMD issue or the IMD does not overlap with any DL carrier under the specified test configurations. |
| R4-2010046 | Apple | CR implementing R4-2010045 proposal for both EN-DC and NE-DC:  Change UL power setting for the lower UL power carrier (either E-UTRA or NR) from minimum output power to 32 dB below PCMAX\_L |
| R4-2010047 | Apple | Mirror CR to R4-2010046 |
| R4-2010320 | NTT DOCOMO | Discussion paper on EN-DC OoBB UE power setup:  Observation 1: Motivation on testing OoBB for inter-band EN-DC is to confirm Rx performance under IM caused by OoBB interfere and UL of the band being not tested, which cannot be confirmed in SA specification.  Observation 2: Same level of Rx performance with LTE CA should be expected in EN-DC mode.  Observation 3: Rx performance of LTE 2UL/2DL CA is confirmed with the condition of Pcmax -7dB for dual UL as LTE 2UL/2DL test case and the condition of Pcmax-4dB for single UL as LTE 1UL/2DL test case (which is tested in fallback combination of 1UL/2DL).  Observation 4: Considering the motivation on OoBB in inter-band EN-DC, the UL transmission power setting of Pcmax -4dB for the band whose DL being not tested should be kept.  Observation 5: Considering the testability issue and impact on already implemented devices, changing the UL transmission power setting as Pcmax –[14-29]dB for the band whose DL being tested should be considered.  **Proposal:** For OoBB for inter-band EN-DC within FR1 with 1 LTE band + 1 NR band, the UL transmission power of bands should be modified as Pcmax -4dB for the band whose DL being not tested and Pcmax –[14-29] dB for the band being tested. |
| R4-2009623 | Qualcomm | CR:  Cross band noise MSD must be added to the following interband ENDC band combinations: DC\_1A\_n40A is missing MSD = 21.5dB for n40 UL BW = 80MHz due to 5th order distortion |
| R4-2009624 | Qualcomm | Mirror CR to R4-2009623 |
| R4-2009625 | Qualcomm | CR:  IMD MSD must be added to the following interband ENDC band combinations: DC\_1A-41A\_n78A is missing IMD4 MSD = 8.7dB for victim B1 like DC\_1A-7A\_n78A; DC\_7A-28A\_n78A needs IMD2 MSD = 28.8dB for victim B28 like DC\_7A\_n28A-n78A, IMD2 MSD needs to increase from 8.3dB to 28.8dB |
| R4-2009626 | Qualcomm | Mirror CR to R4-2009626 |
| R4-2009664 | Anritsu | CR for EN-DC UE REFSENS exceptions:  Added Note so that the value of Minimum requirement can be extended and interpreted to other SCS and BW.  Maintenance: Added SCS of UL band for each band in Table 7.3B.2.3.1-2. |
| R4-2009665 | Anritsu | Mirror CR to R4-2009664 |
| R4-2010020 | Xiaomi | Maintenance CR:  Adding the Uplink configurations for DC\_5-n78  Revising the note13 in table 7.3B.2.3.1-1 to add ∆FHD for DC\_28\_n51 and DC\_66\_n78 |
| R4-2010021 | Xiaomi | Mirror CR to R4-2010020 |
| R4-2010794 | Rohde & Schwarz | Maintenance CR:  Add missing n78 to the bands with MSD |
| R4-2010795 | Rohde & Schwarz | Mirror CR to R4-2010794 |
| R4-2011460 | Skyworks | Moved to topic #3 |
| R4-2009964 | Apple | Maintenance CR:  UL harmonics: Additions for Table 7.3B.2.3.1-1 and Table 7.3B.2.3.1-2  IMD: Table 7.3B.2.3.5.1-1 and Table 7.3B.2.3.5.2-1 |
| R4-2009965 | Apple | Mirror CR to R4-2009964 |

## Open issues summary

5 sub-topics are listed in the below sections. In sub-topic 1-5, the moderator recommends the maintenance/editorial changes (without technical contention) should be merged into one CR.

### Sub-topic 1-1

3 discussion papers were submitted to discuss the UL UE power setups for EN-DC OoBB tests. The main controversy is how much UL power value should be set for the UL band that is being tested. CRs from Apple try to implement their proposals.

**Issue 1-1: how much UL UE power is to be set?**

* How much UL UE power is to be set for the UL band being tested?
  + Option 1: In between PCMAX\_L,c – 14 dB and PCMAX\_L,c – 29 dB
  + Option 2: PCMAX\_L,c – 32 dB
  + Option 3: other value
* Apply PCMAX\_L,c – 4 dB to UL power level for the source of IMD
  + Option 1: Yes
* Recommended WF
  + Agree on PCMAX\_L,c – 4 dB for source of IMD power and discuss to converge on power seting for UL bands being tested.

### Sub-topic 1-2

Band n40 has UE channel BW up to 80MHz. when operating under 80MHz UE channel bandwidth, a separate MSD REFSENS requirement due to cross band isolation is proposed by company that 21.5dB MSD is needed for DC\_1A\_n40A.

**Issue 1-2: additional cross band isolation MSD is needed for DC\_1A\_n40A**

* 21.5dB MSD is specified for UE under CW 80MHz DC\_1A\_n40A
  + Option 1: Yes
  + Option 2: No
  + Option 3: other value
* Recommended WF
  + Agree on the CR and mirror CR to specify the additional cross band isolation MSD for DC\_1A\_n40A if no objection is observed

### Sub-topic 1-3

Problems identified:

* DC\_1A-41A\_n78A is missing IMD4 MSD by DC\_41A\_n78A to band 1
* 8.3dB MSD due to IMD2 from DC\_7\_n78 to band 28 is not enough

**Issue 1-3: add 8.7dB MSD for DC\_1A-41A\_n78A; increase 8.3dB to 28.8dB MSD for DC\_7A-28A\_n78A**

* Add 8.7dB MSD for DC\_1A-41A\_n78A
  + Option 1: Yes
  + Option 2: No
* Increase 8.3dB to 28.8dB MSD for DC\_7A-28A\_n78A
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Agree on the CR and mirror CR if no objection is observed

### Sub-topic 1-4

Problems identified:

* Other SCS-s/BW-s are not defined for EN-DC UE REFSENS than the ones in the tables in 7.3B.2.3
* UL SCS is missing in table 7.3B.2.3.1-2

**Issue 1-4: add note to clarify that for other SCS-s/BW-s the test is also carried out**

* Add notes in MSD tables that: *MSD test points can be chosen according to UE supported BW and SCS*
  + Option 1: Yes
  + Option 2: No
* Add notes in UL configuration tables to clarify that: *if the aggressor band is NR band, the test SCS and UL RB can be adjusted according to UE supported BW and SCS*
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Agree on at least the addition of UL SCS to table 7.3B.2.3.1-2; consider to agree on other parts

### Sub-topic 1-5

REFSENS Maintenance works:

* Note 13 in table 7.3B.2.3.1-1 misses band combinations 10020
* Table 7.3B.2.3.1-2 misses UL SCS-s 09664
* Add missing n78 as an affected band for MSD in DC\_1A\_n78A in table 7.3B.2.3.5.1-1 10794
* Add n78 into n77 boxes of UL harmonics and IMD; add missing MSD requirements due to IMDs 09964

Technical comments on the maintenance CRs are also welcomed in the comment boxes either for sub-topic 1-5 or for the individual CR in section 1.3.2.

**Issue 1-5: REFSENS maintenance works**

* Merge all the REFSENS maintenance works in one CR
  + Option 1: Yes, revise one CR to capture the agreeable parts in each CR
  + Option 2: No, revise every CR that needs to be revised
* If one CR approach is to be used, which CR is to be the baseline?
  + Option 1: R4-2010020 Xiaomi
  + Option 2: R4-2009664 Anritsu
  + Option 3: R4-2010794 R&S
  + Option 4: R4-2009964 Apple
* Recommended WF
  + Agree on one maintenance CR for REFSENS requirements

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 1-1:  how much UL UE power is to be set? | Company 1:  Company 2:  ….  Apple: Option 2: PCMAX\_L,c – 32 dB  We performed the IMD analysis and realized that to avoid the impact from 2UL IMD to OBB test results, one of the UL power needs to be lower than PCMAX\_L,c – 32 dB when the other UL is maintained at PCMAX\_L,c – 4 dB. |
| Issue 1-2:  additional cross band isolation MSD is needed for DC\_1A\_n40A |  |
| Issue 1-3:  add 8.7dB MSD for DC\_1A-41A\_n78A; increase 8.3dB to 28.8dB MSD for DC\_7A-28A\_n78A |  |
| Issue 1-4:  add note to clarify that for other SCS-s/BW-s the test is also carried out | Apple: The MSD test point is discussed based on a specific supported BW and SCS. We would like to ask Anritsu to please clarify if they have an MSD issue with a specific combination. |
| Issue 1-5:  REFSENS maintenance works |  |
| Others: |  |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2010046  R4-2010047 | Company A |
| Company B |
|  |
| R4-2009623  R4-2009624 | Company A |
| Company B |
|  |
| R4-2009625  R4-2009626 | Company A |
| Company B |
|  |
| R4-2009664  R4-2009665 | Company A |
| Company B |
|  |
| R4-2010020  R4-2010021 | Company A |
| Company B |
|  |
| R4-2010794  R4-2010795 | Apple: The missing n78 was already included in our agreed CR (R4-2008413) from last meeting. We had a re-submission to correct the Table format this meeting. (R4-2009964). |
| Company B |
|  |
| R4-2009964  R4-2009965 | 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** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*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*

|  |  |
| --- | --- |
| **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)

## 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: Transmitter requirements

Transmitter requirements corrections are covered in Topic #2. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2010598 | Ericsson | CR to remove Rel-15 allowance for UE to either implement PC2 or PC3 in EN-DC when the UE reports being capable of 2ports SRS in SA:  The power-class ambiguity for a UE indicating NR PC2 and supporting two SRS ports in SA but only one SRS port in NSA is removed. |
| R4-2010123 | SoftBank, NTT DOCOMO, KDDI | CR for Japan:  1) Protections among n5, B74, n77 - n79 are added.  2) Note 13(B3 frequency range), Note 15(NS\_05), Note 19(B41 frequency range) are deleted as protected bands are not relevant to specific CBWs or the requirements are not subject to A-MPR.  3) Japan-related requirements are removed from B38, B40 and B5(which is limited to NB/MTC in Note 4.) Note 4 is also deleted.  4) Some errors are corrected: The contents of Note 10/11 are corrected to align with those of 36.101. |
| R4-2010124 | SoftBank, NTT DOCOMO, KDDI | Mirror CR to R4-2010123. |
| R4-2010921 | Huawei, HiSilicon | Spurious CR:  1. PHS system protection is removed for DC\_1\_n28.  2. Some bands which need harmonic exception are added.  3. EN-DC configuration is replaced by EN-DC band combination |
| R4-2010922 | Huawei, HiSilicon | Mirror CR to R4-2010922. |
| R4-2009661 | Anritsu | Maintenance CR:  Correct the reference number for SCG from TS 36.101 to TS 38.101-1. Also the corresponding clause is changed. |
| R4-2009662 | Anritsu | Mirror CR to R4-2009661. |
| R4-2009975 | KDDI | Maintenance CR:  Correct protected band of band 41/n41 intra-band EN-DC. The requirements follow those of band n41 in TS 38.101-1. |

## Open issues summary

### Sub-topic 2-1

R4-2010598 proposes to delete descriptions in clause 6.1: ~~Unless otherwise stated, if UE indicates IE maxNumberSRS-Ports-PerResource = n2 in NR standalone operation mode, the said UE shall meet the NR requirements for either power class 2 or power class 3 in EN-DC within FR1 if UE indicates IE maxNumberSRS-Ports-PerResource = n1 for EN-DC on this NR band.~~

**Issue 2-1: remove the above descriptions to refrain the UE from implementing either PC2 or PC3 in EN-DC when the UE reports 2ports SRS capability in SA.**

* Proposals
  + Option 1: Yes, remove allowance.
  + Option 2: No, leave it to UE implementation.
* Recommended WF
  + Needs more discussion on the matter.

### Sub-topic 2-2

CR for Japan.

**Issue 2-2: whether to agree on R4-2010123 and its mirror CR for Japan?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on the CRs to implement Changes proposed by operators in Japan if no objection is observed.

### Sub-topic 2-3

Spurious CR.

**Issue 2-3: whether to agree on R4-2010921 and its mirror CR?**

* Remove PHS protection requirements for DC\_1\_n28
  + Option 1: Yes
  + Option 2: No
* Correct EN-DC configuration with EN-DC band combination
  + Option 1: Yes
  + Option 2: No
* Other changes
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Agree on the CRs if no objection.

### Sub-topic 2-4

Maintenance CRs. Technical comments on the maintenance CRs are also welcomed in the comment boxes either for sub-topic 2-4 or for the individual CR in section 2.3.2.

**Issue 2-4: whether to agree on the maintenance CRs?**

* Agree on R4-2009661 and mirror CR
  + Option 1: Yes
* Agree on R4-2009975
  + Option 1: Yes
* Recommended WF
  + Agree on the CRs.

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 2-1:  remove the descriptions to refrain the UE from implementing either PC2 or PC3 in EN-DC when the UE reports 2ports SRS capability in SA | Company 1:  Company 2:  …. |
| Issue 2-2:  whether to agree on R4-2010123 and its mirror CR for Japan |  |
| Issue 2-3:  whether to agree on R4-2010921 and its mirror CR |  |
| Issue 2-4:  whether to agree on the maintenance CRs |  |
| Others: |  |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2010598 | Company A |
| Company B |
|  |
| R4-2010123  R4-2010124 | Company A |
| Company B |
|  |
| R4-2010921  R4-2010922 | Company A |
| Company B |
|  |
| R4-2009661  R4-2009662 | Company A |
| Company B |
|  |
| R4-2009975 | 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:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

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

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

|  |  |
| --- | --- |
| **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)

## 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: EN-DC configuration

Several other issues are covered in Topic #3. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009964 | Apple | Moved to Topic #1. |
| R4-2009965 | Apple | Moved to Topic #1. |
| R4-2010825 | Huawei, HiSilicon | EN-DC configurations:  Add a new NOTE for DC\_20\_n28 to avoid the unnecessry performance degradation under inappropriate scenario which cannot meet conditions in Note 10 and Note 11. |
| R4-2010826 | Huawei, HiSilicon | Mirror CR to R4-2010825 |
| R4-2011460 | Skyworks | DC\_42\_n79 CR:  Add Note 3 to DC\_42\_n79  Mirror part for Rel-16 is in R4-2011515, thread 121. |

## Open issues summary

### Sub-topic 3-1

In the EN-DC configuration table, the statement (note 10 and note 11) specifies some conditions for UE to meet corresponding EN-DC requirements. However, such conditions can only be met under co-located deployment scenario. To make it clear that performance may not be guaranteed under inappropriate scenario, an additional Note is added for clarification.

**Issue 3-1: Further clarify on the co-located scenario for DC\_20\_n28.**

* Add a note 12 to clarify that note 10 and note 11 mean co-located deployment
  + Option 1: Yes, it needs further clarification.
  + Option 2: No need to have a new note.
* Recommended WF
  + Needs more discussion on the matter.

### Sub-topic 3-2

Wether DC\_42\_n79 supports simultaneous Tx/Rx is ambiguous, it cannot be supported by solutions implemented with n77 or n78 filter without MSD as already shown for CA\_n79-n79.

**Issue 3-2: whether to add note 3 to DC\_42\_n79?**

* Add note 3 to DC\_42\_n79 in the configuration table
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + If the CR is agreeable, endorse it and merge. Or we agree on the CR and ask for a new mirror CR number for Rel-16.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 3-1:  Further clarify on the co-located scenario for DC\_20\_n28 | Company 1:  Company 2:  …. |
| Issue 2-2:  whether to add note 3 to DC\_42\_n79 |  |
| Others: |  |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2010825  R4-2010826 | Apple: For the correct implementation of mirror CR we would like to highlight that the NOTE numbering is different in the specification of Rel-15 to the Rel-16. |
| Company B |
|  |
| R4-2011460 | 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:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

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

### 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)

## 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”* |