**3GPP TSG-RAN WG4 Meeting # 98-e R4-21xxxxx**

**Electronic Meeting, Jan. 25- Feb. 5, 2021**

**Agenda item:** 11.10.4

**Source:** Moderator (CATT)

**Title:** Email discussion summary for [98e][143] NRSL\_enh\_Part\_2

**Document for:** Information

# Introduction

In RAN4#97e meeting, partially used SL operation with Uu in licensed band is included in the scope of NR SL enhancement in Rel-17. This email discussion summary will focus on operating scenarios and synchronous operation for partially used SL operation with Uu.

The agenda items involved are as follows:

*11.10.4 Partially used SL operation with NR Uu operating bands [NRSL\_enh-Core]*

*11.10.4.1 Operating scenarios for partially used SL operation [NRSL\_enh-Core]*

*11.10.4.2 Synchronous operation between NR Uu and NR SL in an operating band [NRSL\_enh-Core]*

*11.10.4.3 Others [NRSL\_enh-Core]*

The candidate targets of this email discussion for 1st round and 2nd round:

* 1st round
  + Companies to provide comments on each sub-topic and try to converge.
  + Assign the corresponding WF after the 1st round discussion if needed.
* 2nd round
  + Capture the agreements and open issues if any in WF and further discuss the WF.
  + Recommend the final status of the WF if any.

# Topic #1: Operating scenarios for partially used SL operation

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2102346 | Ericsson | Title: SL UE Timing mask for Partially used SL operation with NR Uu operating bands  Observation#1: There should not be any switch time between Uu to SL switch to keep the DL time alignment principle.  Proposal: Consider the above the TDM timing mask for partially used SL operation with NR Uu operating bands in licensed band operation. |
| [R4-2100415](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014425.zip) | CATT | Title: Discussion on operating scenarios for partial used SL operation  Observation 1: For Case 2, NR SL UE should transmit SL on UL slot while NR SL UE only receives DL on DL slot. The timing alignment issue needs be studied including synchronization reference source, timing advancing and switching time mask between Uu and SL.  Observation 2: For Case 3, the RF requirements and RF architecture of intra-band CA in band n79 could be considered as a starting point for intra-band V2X con-current operation in band n79.  Proposal: It is proposed to prioritize Case 2 and Case 3 and deprioritize Case 1 and Case 4. |
| R4-2100784 | vivo | Title: General issues about licensed bands partially used for SL  Proposal 1: It is proposed to agree on the following UE operations for licensed bands partially used for SL in Rel-17: a) NR UE operates in the licensed band through Uu interface only; b) NR V2X UE operates in the licensed band through PC5 interface only; c) NR V2X UE operates in the licensed band through Uu and PC5 synchronously.  Proposal 2: Agree on the working assumptions of RF architectures for UEs supporting the scenario licensed bands partially used for SL.  Proposal 3: RAN4 needs to define the core requirements for single carrier operation and intra-band con-current operation for the scenario licensed bands partially used for SL.  Proposal 4: For the synchronous operation between Uu and SL in the same licensed TDD bands, NR SL should use network as the synchronization reference source. |
| [R4-2101875](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009834.zip) | Xiaomi | Title: On operating scenarios for partially used SL operation  Observation 1: For UL and SL are FDMed operation, the licensed band partially used for sidelink is similar to the scenario of 2UL intra-band CA scenario in case the synchronization of SL and UL is aligned.  Observation 2: Frequency separation needs to be investigated in case simultaneous UL and SL RX for FDMed UL and SL operation.  Observation 3: Shared or separate antenna architecture needs also to be taken into consideration when defining requirements.  Observation 4: For UL and SL are TDMed operation, switching period mask from UL to SL and SL to UL needs to be defined. |
| [R4-2102343](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009834.zip) | Ericsson | Title: Operating scenarios for partially used SL operation  Proposal: RAN4 discuss the above scenario to be considered for SL operation partially in a licensed band. |
| [R4-2100283](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100283.zip) | LG Electronics France | Title: Consideration on partial usage operation with PC5 and Uu in a licensed band  Observation 1: Only a separate RF architecture between Uu RF path and PC5 RF path is possible to support different transmission time.  Observation2: Even though there is a Tx time difference between PC5 and Uu, RAN4 expect there would be no self-interference problem in its own device.  Proposal 1: RAN4 allow TDM operation between PC5 and Uu operation in a licensed TDD band.  Proposal 2: RAN4 can specify the con-current V2X operation in TDD intra-band without in-device coexistence study. For the FDD intra-band con-current operation, RAN4 need further discussion on the detail coexistence scenarios.  Proposal 3: Based on Table 3.1, RAN4 further study the detail MPR/A-MPR simulation assumptions and specification for intra-band con-current V2X operation. |
| [R4-2101877](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101877.zip) | Xiaomi | Title: Synchronous operation between NR Uu and NR SL in an operating band  Observation 1: Current timing setting as 0 timing advance has not considered the synchronous operation between NR Uu and NR SL.  Observation 2: When SL timing is aligned to UL timing, the synchronous NR Uu and NR SL operation is similar to 2UL carrier aggregation from UE perspective. Proposal 1: For specific synchronous operation of NR Uu and NR SL, the timing advance of SL to DL is aligned with the timing advance of UL to DL.  Observation 3: Separate antenna architecture is assumed for UL and SL simultaneous transmission scenario. |

## Open issues summary

Based on above contributions, the following sub-topics and issues regarding operating scenarios for partially used SL operation will be discussed in this clause:

* Sub-topic 1-1: TDM operation between SL and Uu
* Issue 1-1-1: Whether to introduce TDM operation between SL and Uu
* Issue 1-1-2: Time mask for SL and Uu switching
* Sub-topic 1-2: FDM operation between SL and Uu
* Issue 1-2-1: Whether to introduce FDM operation between SL and Uu
* Issue 1-2-2: Frequency separation
* Sub-topic 1-3: UE RF architecture for partially used SL with Uu
* Issue 1-3-1: Whether the RF architecture of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79
* Issue 1-3-2: Whether the core RF requirements of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79
* Issue 1-3-3: Shared antenna architecture or separate antenna architecture
* Sub-topic 1-4: Other related issues
* Issue 1-4-1: Intra-band V2X con-current operation
* Issue 1-4-2: MPR/A-MPR for intra-band V2X con-current operation

### Sub-topic 1-1: TDM operation between SL and Uu

**Issue 1-1-1: Whether to introduce TDM operation between SL and Uu**

* Proposals
  + Option 1: RAN4 allow TDM operation between spectrally partially used PC5 SL and Uu UL/DL operation in a licensed TDD band.
  + Other options are not precluded.
* Recommended WF
  + Need more discussion.

**Issue 1-1-2: Time mask for SL and Uu switching**

* Proposals
  + Option 1: Consider the TDM timing mask for partially used SL operation with NR Uu in paper R4-2102346.
  + Other options are not precluded.
* Recommended WF
  + More potential issues that have impact on time mask for SL and Uu switching should be explored.

### Sub-topic 1-2: FDM operation between SL and Uu

**Issue 1-2-1: Whether to introduce FDM operation between SL and Uu**

* Proposals
  + Option 1: RAN4 should allow FDM operation for partially used SL with Uu in licensed band
  + Other options are not precluded.
* Recommended WF
  + Need more discussion.

**Issue 1-2-2: Frequency separation**

* Proposals
  + Option 1: RAN4 study frequency separation in case of FDM operation between SL and Uu
  + Other options are not precluded.
* Recommended WF
  + The further details on how frequency separation can be derived, e.g. simulation assumptions, should be discussed.

### Sub-topic 1-3: UE RF architecture for partially used SL with Uu

**Issue 1-3-1: Whether the RF architecture of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79**

* Proposals
  + Option 1: YES
  + Option 2: NO
* Recommended WF
  + Need more discussion.

**Issue 1-3-2: Whether the core RF requirements of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79**

* Proposals
  + Option 1: YES
  + Option 2: NO
* Recommended WF
  + Need more discussion.

**Issue 1-3-3: Shared antenna architecture or separate antenna architecture**

* Proposals
  + Option 1: Shared antenna architecture
  + Option 2: Separate antenna architecture
* Recommended WF
  + Need more discussion.

### Sub-topic 1-4: Other related issues

**Issue 1-4-1: Intra-band V2X con-current operation**

* Proposals
  + Option 1: RAN4 can specify the con-current V2X operation in TDD intra-band without in-device coexistence study. For the FDD intra-band con-current operation, RAN4 need further discussion on the detail coexistence scenarios.
  + Other options are not precluded.
* Recommended WF
  + Need more discussion.

**Issue 1-4-2: MPR/A-MPR for intra-band V2X con-current operation**

* Proposals
  + Option 1: RAN4 further study the detailed MPR/A-MPR simulation assumptions and specification for intra-band con-current V2X operation.
  + Other options are not precluded.
* Recommended WF
  + Need more discussion.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| **Vivo** | **Issue 1-1-1: Whether to introduce TDM operation between SL and Uu**  What does the wording ‘spectrally partially used for SL and Uu’ mean in option 1? In our interpretation, only TDM operation in different carriers are considered for SL and Uu, but not in the same carrier. Why preclude the scenario in the same carrier? We need clarification of that.  **Issue 1-1-2: Time mask for SL and Uu switching**  It is early to discuss time mask before we agree on the UE operations for licensed bands partially used SL.  **Issue 1-2-1: Whether to introduce FDM operation between SL and Uu**  For Option 1, on what condition, FDM between SL and Uu is allowed? Do we need to add a condition that SL can only be transmitted in the UL of the Uu?  **Issue 1-2-2: Frequency separation**  Why do we need to study frequency separation?  **Issue 1-3-1: Whether the RF architecture of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79**  **Issue 1-3-2: Whether the core RF requirements of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79**  For Issue 1-3-1/2, we think the RF architecture and requirements are related to specific UE operations. These issues can be discussed after we agree on the UE operations.  **Issue 1-3-3: Shared antenna architecture or separate antenna architecture**  What does this antenna architecture mean? Antenna plus RF chain?  In our understanding, antennas can be shared and RF chains should be separated for Uu and SL.  **Issue 1-4-1: Intra-band V2X con-current operation**  For Option 1, what’s the technical reason for not considering in-device co-existence study in TDD band? For FDD, we may not need to do the coexistence study.  **Issue 1-4-2: MPR/A-MPR for intra-band V2X con-current operation**  We agree with Option 1. Besides MPR/A-MPR for PC3, we may also need to consider PC2 for the simulation assumptions since we are discussing introducing HPUE for SL. |
| **LGE** | **Issue 1-1-1: Whether to introduce TDM operation between SL and Uu**  **LGE:** prefer Option 1: RAN4 allow TDM operation between spectrally partially used PC5 SL and Uu UL/DL operation in a licensed TDD band.  **Issue 1-1-2: Time mask for SL and Uu switching**  **LGE:** It is depend on RAN4 agreements the position of switching period between LTE SL and NR SL at n47**.** For the consistency, RAN4 can wait to define the TDM time mask in licensed band.  **Issue 1-2-1: Whether to introduce FDM operation between SL and Uu**  **LGE:** prefer Option 1in TDD licensed band: RAN4 should allow FDM operation for partially used SL with Uu in TDD licensed band. In FDD band, the the UL transmission is not restricted, so the V2X SL reception in UL frequency can be impacted in FDD band. So RAN4 need to study the frequency gap in FDD licensed band.  **Issue 1-2-2: Frequency separation**  **LGE:** For the FDM operation in TDD band, based on the LGE analysis paper (R4-2100283), RAN4 can allow FDM operation in TDD licensed band with restriction of SL Tx/Rx only allowed in UL configuration when NR Uu has not transmitted signalling.  **Issue 1-3-1: Whether the RF architecture of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79**  **LGE:** prefer option2: No.For the RF architecture of V2X intra-band con-current operation shall consider separate RF architecture. In 2UL intra-band CA, there are two different RF architectures. One is single RF architecture for 2UL intra-band contiguous CA and the other is separate 2PA RF architecture for 2UL intra-band non- contiguous CA. So it is not applicable to the V2X intra-band con-current operation.  **Issue 1-3-2: Whether the core RF requirements of 2UL intra-band CA could apply to V2X intra-band con-current operation in band n79**  **LGE:** prefer option2: No.For the MPR/A-MPR, RAN4 need to analyse the specific A-MPR requirements according to each channel such as PSCCH/PSSCH, S-SSB and PSFCH transmission. Also if RAN4 consider different RF architecture, RAN4 need to study the detail RF core requirements as mentioned in LGE paper (R4-2100283)  **Issue 1-3-3: Shared antenna architecture or separate antenna architecture**  **LGE:** prefer option2: separate RF architecture  **Issue 1-4-1: Intra-band V2X con-current operation**  **LGE:** prefer option1: RAN4 can specify the con-current V2X operation in TDD intra-band without in-device coexistence study. For the FDD intra-band con-current operation, RAN4 need further discussion on the detail coexistence scenarios.  **Issue 1-4-2: MPR/A-MPR for intra-band V2X con-current operation**  **LGE:** prefer option1: RAN4 further study the detailed MPR/A-MPR simulation assumptions and specification for intra-band con-current V2X operation. |
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### 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.*

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| **CR/TP number** | **Comments collection** |
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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:*  *Candidate options:*  *Recommendations for 2nd round:* |
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*Recommendations 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 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”* |
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## Discussion on 2nd round (if applicable)

## Companies views’ collection for 2st round

### Open issues

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| **Company** | **Comments** |
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### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
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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”* |
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# Topic #2: Synchronous operation between Uu and SL

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2100416](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100416.zip) | CATT | Title: Discussion on synchronous operation between NR Uu and NR SL  Proposal 1: When SL and Uu are operated in the same licensed band, network should be used as synchronization reference source for SL.  Proposal 2: SL timing should be aligned with UL timing of Uu instead of Uu when SL and Uu are operated in the same licensed band. |
| R4-2100784 | vivo | Title: General issues about licensed bands partially used for SL  Proposal 1: It is proposed to agree on the following UE operations for licensed bands partially used for SL in Rel-17: a) NR UE operates in the licensed band through Uu interface only; b) NR V2X UE operates in the licensed band through PC5 interface only; c) NR V2X UE operates in the licensed band through Uu and PC5 synchronously.  Proposal 2: Agree on the working assumptions of RF architectures for UEs supporting the scenario licensed bands partially used for SL.  Proposal 3: RAN4 needs to define the core requirements for single carrier operation and intra-band con-current operation for the scenario licensed bands partially used for SL.  Proposal 4: For the synchronous operation between Uu and SL in the same licensed TDD bands, NR SL should use network as the synchronization reference source. |
| [R4-2102345](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102345.zip) | Ericsson | Title: SL UE synchronization issue for licensed operation  Observation#1: To avoid the interference to the network UL receiving, the SL guard period should be greater than (2\*Tp+ Transient time)  Observation#2: If Uu transmission should happen after SL transmission at time slot immediately after SL transmission, to avoid the disturbance to its own SL transmission, the SL guard period should be greater than (3\*Tp+ 2\*Transient time)  Observation#3: The time mask for the SL and Uu TDM operation needs to be discussed together with the synchronization discussion.  Proposal-1: RAN4 discuss the benefit of the introducing the Uplink timing alignment for both TDM and FDM mode. Possible LS could be sent to RAN1 if agreement deviate from the RAN1 agreement in Rel-16. |
| [R4-2100283](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100283.zip) | LG Electronics France | Title: Consideration on partial usage operation with PC5 and Uu in a licensed band  Observation 1: Only a separate RF architecture between Uu RF path and PC5 RF path is possible to support different transmission time.  Observation2: Even though there is a Tx time difference between PC5 and Uu, RAN4 expect there would be no self-interference problem in its own device.  Proposal 1: RAN4 allow TDM operation between PC5 and Uu operation in a licensed TDD band.  Proposal 2: RAN4 can specify the con-current V2X operation in TDD intra-band without in-device coexistence study. For the FDD intra-band con-current operation, RAN4 need further discussion on the detail coexistence scenarios.  Proposal 3: Based on Table 3.1, RAN4 further study the detail MPR/A-MPR simulation assumptions and specification for intra-band con-current V2X operation. |
| [R4-2101877](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101877.zip) | Xiaomi | Title: Synchronous operation between NR Uu and NR SL in an operating band  Observation 1: Current timing setting as 0 timing advance has not considered the synchronous operation between NR Uu and NR SL.  Observation 2: When SL timing is aligned to UL timing, the synchronous NR Uu and NR SL operation is similar to 2UL carrier aggregation from UE perspective. Proposal 1: For specific synchronous operation of NR Uu and NR SL, the timing advance of SL to DL is aligned with the timing advance of UL to DL.  Observation 3: Separate antenna architecture is assumed for UL and SL simultaneous transmission scenario. |

## Open issues summary

Based on above contributions, the following sub-topics and issues regarding synchronous operation between Uu and SL will be discussed in this clause:

* Sub-topic 2-1: Transmission timing between SL and Uu
* Issue 2-1-1: Transmission timing between SL and Uu
* Issue 2-1-2: SL guard period
* Sub-topic 2-2: Synchronization reference source
* Issue 2-2-1: Synchronization reference source for SL

### Sub-topic 2-1: Transmission timing between SL and Uu

**Issue 2-1-1: Transmission timing between SL and Uu**

* Proposals
  + Option 1: SL transmission timing should be aligned with UL timing of Uu.
  + Option 2: SL transmission timing should be aligned with DL timing of Uu.
  + Option 3: RAN4 discuss the benefit of the introducing the Uplink timing alignment for both TDM and FDM mode. Possible LS could be sent to RAN1 if agreement deviate from the RAN1 agreement in Rel-16.
* Recommended WF
  + Need more discussion.

**Issue 2-1-2: SL guard period**

* Proposals
  + Option 1: To avoid the interference to the network UL receiving, the SL guard period should be greater than (2\*Tp+ Transient time). If Uu transmission should happen after SL transmission at time slot immediately after SL transmission, to avoid the disturbance to its own SL transmission, the SL guard period should be greater than (3\*Tp+ 2\*Transient time).
  + Option 2: Even though there is a Tx time difference between PC5 and Uu, RAN4 expect there would be no self-interference problem in its own device.
  + Other options are not precluded.
* Recommended WF
  + Need more discussion.

### Sub-topic 2-2: Sychronization reference source

**Issue 2-2-1: Synchronization reference source for SL**

* Proposals
  + Option 1: Use network as synchronization reference source.
  + Option 2: Check RAN1 decision and follow RAN1 agreements.
* Recommended WF
  + Need more discussion.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| vivo | Issue 2-1-1: Transmission timing between SL and Uu  RAN1’s agreement is consistent with Option 1. Option 3, maybe a typo, in Rel-17?  Issue 2-1-2: SL guard period  Is this issue discussed in option1 within the scope of RAN4?  Issue 2-2-1: Synchronization reference source for SL  OK with option1. Check with RAN1 is also OK. |
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### 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.*

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
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| YYY | Company A |
| Company B |
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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:*  *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*

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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”* |