**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 8.2.2, 8.2.3

**Source:** LG Electronics

**Title:** Email discussion summary for RAN4#94e\_#49\_NR\_CLI\_RIM\_RRM

**Document for:** Information

# Introduction

This email discussion is for Rel-16 CLI RRM core maintenance and performance in Agenda 8.2.2 and 8.2.3. List of candidate target of email discussion for 1st round as follows:

* 1st round:
	+ Topic#1 : CLI core requirement maintenance
		- Sub-topic 1-1 : Scheduling restriction
	+ Topci#2 : CLI performance requirements
		- Sub-topic 2-1 : CLI measurement accuracy
		- Sub-topic 2-2 : CLI performance test case
		- Sub-topic 2-3 : Minimum SRS RP

# Topic #1: CLI core requirement maintenance

Rel-16 CLI core was closed in last RAN4 meeting. This section will treat CLI core maintenance. Issues are listed in the following sub-section.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000653 | Nokia, Nokia Shanghai Bell | **Proposal1**: The RAN4 scheduling restriction on the PDCCH/PDSCH reception is not valid and shall be updated to align with RAN2 agreements.**Proposal2**: RAN4 have following questions clarified to properly update the RAN4 spec on scheduling restriction:1. Does the UE keep monitoring the PDCCH/PDSCH on the CLI measurement resources? 2. Does the UE measure CLI on the SRS RSRP resources after DL reception if being scheduled, in case DL signal/channel and SRS RSRP resources are FDMed and the UE does not support FDMed reception?3. Does the UE prioritize DL transmission on the 1 or 2 OFDM symbols before the OFDM symbol used for CLI measurements? **Proposal3**: It is proposed to send LS to RAN2 asking the above questions and confirm the RAN4 understanding if there is any consensus. |
| R4-2000960 | LG Electronics Inc. | **Proposal**: Update scheduling availability for CLI measurement based on CLI capabilities. |
| R4-2001621 | Huawei, HiSilicon | **Proposal 3**: RAN4 should inform RAN2 about the RAN4 agreement to apply scheduling restriction for CLI measurement, and suggest RAN2 to revisit their agreements as indicated in [3]. |
| R4-2001622 | Huawei, HiSilicon | Reply LS on CLI measurement capability |

## Open issues summary

### Sub-topic 1-1 : Scheduling restriction

There are conflicting agreement between RAN2 and RAN4 for UE behavior when DL signal/channel and CLI measurement resources are FDMed. RAN4 needs to decide whether to keep RAN4 agreement for scheduling restriction.

RAN2 agreed UE capabilities for FDMed between DL signal/channel and CLI measurement resources. Based on these UE capabilities, RAN4 needs to update scheduling restriction part in RAN4 specification, provided that it will decide after Issue 1-1 is clear.

**Issue 1-1-1: Conflicting UE behaviour between RAN2 and RAN4**

* Proposals
	+ Option 1: Align with RAN2 agreements and clarify UE behaviour for FDMed scenarios
	+ Option 2: keep RAN4 agreements and send LS to RAN2
* Recommended WF
	+ TBA

**Issue 1-1-2: Scheduling restriction based on UE capabilities**

* Proposals
	+ Option 1: Update scheduling restriction based on UE capabilities for FDMed between DL signal/channel and CLI measurement resource
* Recommended WF
	+ TBA

**Issue 1-1-3: handling LS**

* Proposals
	+ Moderator : depending on conclusion of Issue 1-1-1.
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 1-1-1 : Conflicting UE behaviour between RAN2 and RAN4**

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| --- | --- |
| **Company** | **Comments** |
| LG  | Support option 2.UE behavior for measurements should be considered in RAN4. So, RAN4 needs to send LS with RAN4 agreements to RAN2. |
| Huawei, HiSilicon | Support option 2. If option 1 is adopted, CLI measurement would have no guaranteed performance due to dynamic scheduling in the serving cell. Also the UE behavior would be complex as UE needs to determine if there is DL signals/channels overlapping with the CLI measurement resource early enough.  |
| QC | We support option 2 also. In general, in RAN4 we have been prioritizing measurements over DL/UL. We should keep the same here and keep the scheduling restrictions in place.  |
| Nokia, Nokia Shanghai Bell | RAN4 should follow RAN1/RAN2 agreements and then adapts the RAN4 spec. As the details of the scheduling principles are not clear, we need send LS to RAN1/RAN2 for the clarification.  |
| LG | For Nokia comments,In general, RAN4 follows RAN1/RAN2 agreements, but UE behavior related measurement should be decided in RAN4 due to guarantee measurement performance. Additionally, RAN2 agreements for this issue are not captured in RAN2 specification, and if it is critical issue in RAN2, RAN2 would have informed this decision to RAN4. So, Option 2 should be considered. |
| NEC | We also support Option 2. Same view as QC. |

**Issue 1-1-2 : Scheduling restriction based on UE capabilities**

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| --- | --- |
| **Company** | **Comments** |
| LG  | According to RAN2 UE capability for FDMed between DL signal/channel and CLI measurement resource, RAN4 needs to capture it in scheduling restriction part. |
| Huawei, HiSilicon | Support option 1. If it is agreeable, we assume the proponent (LGE) will prepare CR during the meeting to capture it.  |
| QC | Updating with actual capability names makes sense |
| Nokia, Nokia Shanghai Bell | The UE capabilities need to be updated in accordance with RAN2 definition. But it can be done after issue 1-1-1 is solved. |
| NEC | Since there is conflicting UE behavior between RAN2 and RAN4, we also feel that it can be done after issue 1-1-1 is resolved.  |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2001623 | LG : Following sentence in this CR is better to move into chapter 9.7.1 with revised *For performing CLI measurement in FR2, UE can assume the configured CLI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET.* |
| Huawei, HiSilicon: we are fine with above comments from LGE, and will take it in the revision. |
| Nokia, Nokia Shanghai Bell: It needs further discussion. UE behavior shall be firstly clarified by RAN1/2. |
|  |

## 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:* |

*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”* |

## 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: CLI performance requirements

Rel-16 CLI performance part start from RAN4#94-e. This section discuss CLI performance test cases and configurations for SRS-RSRP and CLI-RSSI. Issues are listed in the following sub-section.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000654 | Nokia, Nokia Shanghai Bell | **Proposal1**: It is proposed to adopt the CLI accuracy requirements values as defined in Table 1. |
| R4-2001621 | Huawei, HiSilicon | **Proposal 1**: The SRS-RSRP accuracy requirements at normal condition and normal Io are- FR1: 3.5dB for 15kHz, 4dB for 30kHz, 5.5dB for 60kHz- FR2: 6.5dB for 60kHz, 10dB for 120kHz**Proposal 2**: Re-use LAA RSSI accuracy requirements for CLI-RSSI for FR1, and allow 1.5dB relaxation for CLI-RSSI for FR2. |
| R4-2000962 | LG Electronics Inc. | **Proposal**: Use SRS-RSRP measurement accuracy of Table 2-1. |
| R4-2000958 | LG Electronics Inc. | **Proposal**: Use Table 2-1 and Table 2-2 for minimum SRS RP level for FR1 and FR2 |
| R4-2000961 | LG Electronics Inc. | **Proposal 1**: Select one option for SRS-RSRP measurement accuracy tests depending on SCS configuration.**Proposal 2**: Use timing error as TC × NTA\_offset + 4.67us for FR1 and TC × NTA\_offset + 3.67us for FR2**Proposal 3**: Use SRS configuration for SRS-RSRP measurement accuracy test in Table 2-2.**Proposal 4**: Use AoA steup#1 for CLI measurement tests in FR2. |
| R4-2001625 | Huawei, HiSilicon | **Proposal**: Agree on the test case list as in Table 1-4. |

## Open issues summary

### Sub-topic 2-1 : CLI measurement accuracy

Collecting simulation results for SRS-RSRP based on last meeting agreements to define CLI measurement accuracy.

**Issue 2-1-1: Define measurement accuracy for SRS-RSRP**

* Proposals
	+ Companies’ proposals (normal condition) are summarized in following table

|  |  |  |
| --- | --- | --- |
| FR | SCS | Accuracy Requirement ( ±[ ]dB) |
| Huawei | Nokia | LG |
| FR1 | 15kHz | 3.5 | 2.9 | 3 |
| 30kHz | 4 | 3.5 | 4 |
| 60kHz | 5.5 | 5 | 5.5 |
| FR2 | 60kHz | 6.5 | 5.8 | 6.5 |
| 120kHz | 10 | 8.4 | 8.5 |

* Recommended WF
	+ TBA

**Issue 2-1-2: Define measurement accuracy for CLI-RSSI**

* Proposals
	+ Option 1: Re-use LAA RSSI accuracy requirements for CLI-RSSI for FR1, and allow 1.5dB relaxation for CLI-RSSI for FR2.
* Recommended WF
	+ TBA

**Issue 2-1-3: Measurement accuracy for extreme condition and high Io**

* Proposals
	+ Option 1:
		- Extreme condition with Io=-70dBm/BW is derived by adding 4.5/3dB for FR1/FR2 to the absolute L1-RSRP accuracy in normal condition.
		- Normal condition with Io=-50dBm/BW is derived by adding 3.5/3dB for FR1/FR2to the absolute L1-RSRP accuracy in normal condition with Io=-70dBm/BW.
		- Extreme condition with Io=-50dBm/BW is derived by adding 2/2dB for FR1/FR2 to the absolute L1-RSRP accuracy in extreme condition with Io=-70dBm/BW.
* Recommended WF
	+ TBA

### Sub-topic 2-2 : CLI performance test case

This sub-section discusses test case lists and test configurations for SRS-RSRP and CLI-RSSI.

**Issue 2-2-1: Test case list**

* Proposals
	+ Option 1: (R4-2001625)
		- Event triggered reporting test cases for FR1/FR2 EN-DC/SA
			* With non-DRX / with DRX
		- Measurement accuracy test cases for FR1/FR2 EN-DC/SA
* Recommended WF
	+ TBA

**Issue 2-2-2: Test configuration: sub-tests for measurement accuracy**

* Proposals
	+ Option 1:
		- SRS-RSRP for FR1: 3 sub-tests with different SRS-RSRP and Io levels (similar to SS-RSRP)
		- SRS-RSRP for FR2: 2 sub-tests with different SRS-RSRP and Io levels (similar to SS-RSRP)
		- CLI-RSSI : 1 sub-test (similar to LAA RSSI)
* Recommended WF
	+ TBA

**Issue 2-2-3: Test configuration: SCS & BW**

* Proposals
	+ Option 1: 15kHz+10MHz, 30kHz+40MHz, 120k+100MHz
* Recommended WF
	+ TBA

**Issue 2-2-4: Test configuration: timing difference between DL and CLI measurement resource**

* Proposals
	+ Option 1: TC × NTA\_offset + 4.67us for FR1 and TC × NTA\_offset + 3.67us for FR2
* Recommended WF
	+ TBA

**Issue 2-2-5: Test configuration: SRS configuration for SRS-RSRP**

* Proposals
	+ Option 1: reuse the same format SRSConf.1 of Table A.4.4.1.1.1-3 in TS38.133
		- freqHopping c-SRS :12
		- SRS is configured on the last symbol in the S-slot
* Recommended WF
	+ TBA

**Issue 2-2-6: Test configuration: AoA setup**

* Proposals
	+ Option 1: AoA setup#1 for FR2 test cases
* Recommended WF
	+ TBA

### Sub-topic 2-3 : Minimum SRS RP

This sub-section discusses minimum SRS\_RP value for FR1 and FR2

**Issue 2-3-1: Minimum SRS\_RP**

* Proposals
	+ Option 1:
		- For FR1

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **NR operating band groups Note1** | **Minimum SRS\_RP** | **SRS Ês/Iot** |
| **dBm / SCSSRS** | **dB** |
| **SCSSRS = 15 kHz** | **SCSSRS = 30 kHz** | **SCSSRS = 60 kHz** |
| **Conditions** | NR\_TDD\_FR1\_A | -120 | -117 | -114 | ≥ 1 |
| NR\_TDD\_FR1\_C | -119 | -116 | -113 |
| NR\_TDD\_FR1\_D | -118.5 | -115.5 | -112.5 |
| NR\_TDD\_FR1\_E | -118 | -115 | -112 |
| NOTE 1: NR operating band groups are defined in clause 3.5.2. |

* + - For FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Angle of arrival | NR operating bands | Minimum SRS\_RP Note 2, Note 3 | SRS Ês/Iot |
| dBm / SCSSRS | dB |
| SCSSRS = 60 kHz | SCSSRS = 120 kHz |
| UE Power class | UE Power class |
| **1** | **2** | **3** | **4** | **1, 2, 3, 4** |
| **Conditions** | Rx Beam Peak | n257 | -124.5 | -119.0 | -115.3 | -124.0 | (Value for SCSSRS = 60 kHz) +3dB  | ≥1 |
| n258 | -124.5 | -119.0 | -115.3 | -124.0 |
| n260 | -121.5 |  | -112.7 | -122.0 |
| n261 | -124.5 | -119.0 | -115.3 | -124.0 |
| Spherical coverage **Note 1** | n257 | -116.5 | -108.0 | -104.4 | -115.0 | (Value for SCSSRS = 60 kHz) +3dB  | ≥1 |
| n258 | -116.5 | -108.0 | -104.4 | -115.0 |
| n260 | -113.5 |  | -100.1 | -110.0 |
| n261 | -116.5 | -108.0 | -104.4 | -115.0 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.NOTE 2: Values specified at the Reference point to give minimum SRS Ês/Iot, with no applied noise.NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ΣMBP and Spherical coverage values are increased by ΣMBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. |

* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

**Sub-topic 2-1 : CLI measurement accuracy**

**Issue 2-1-1: Define measurement accuracy for SRS-RSRP**

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| --- | --- |
| **Company** | **Comments** |
| LG | we suggest following values for SRS-RSRP measurement accuracy (majority values)

|  |  |  |
| --- | --- | --- |
| FR | SCS | Accuracy Requirement ( ±[ ]dB) |
| FR1 | 15kHz | 3 |
| 30kHz | 4 |
| 60kHz | 5.5 |
| FR2 | 60kHz | 6.5 |
| 120kHz | 9 |

 |
| Huawei, HiSilicon | For most cases results from 3 companies (Nokia, LGE and Huawei) are aligned with the difference < 0.5dB. The exception case is the 120kHz for which the results are listed below. It seems LGE’s results are clearly better than Nokia’s and ours. We suggest to keep requirements for this case FFS.

|  |  |
| --- | --- |
| Channel | Max (5%, 95%) in the results |
| Huawei | Nokia | LG |
| AWGN | 4.3 | 4.4 | 3.8 |
| TDL-A | 5.6 | 4.8 | 4.3 |
| TDL-C | 5.2 | 5.2 | 4.3 |

We would like to also note that proposed requirements in Nokia paper R4-2000654 are based on AWGN results. It should be based on worst case among all channels instead.  |
| QC | Question for clarification, do the numbers proposed above contain the RF margin or do we add margin on top? |
| Nokia, Nokia Shanghai Bell | The performance requirement shall be defined under AWGN channel. The averaged value can be considered under the same simulation assumption.  |
| LG | For QC’s commentsThe proposed values have already captured certain RF margin.For Nokia’s commentsI have the same understanding with Huawei. It should be based on worst case among all channelsFor all, I think that following measurement accuracy is agreeable except 120kHz in FR2.

|  |  |  |
| --- | --- | --- |
| FR | SCS | Accuracy Requirement ( ±[ ]dB) |
| FR1 | 15kHz | 3 |
| 30kHz | 4 |
| 60kHz | 5.5 |
| FR2 | 60kHz | 6.5 |
| 120kHz | FFS |

For 120kHz in FR2, we have two possible approachesAlt1: use average value among companies’ results (9dB)Alt2: keep FFS, and discuss it in the next F2F meeting  |

**Issue 2-1-2: Define measurement accuracy for CLI-RSSI**

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| --- | --- |
| **Company** | **Comments** |
| LG | We are fine to reuse LAA RSSI measurement requirements for CLI-RSSI. |
| Huawei, HiSilicon | Option 1. It should be noted that in option 1 there is a 1.5dB relaxation for FR2 considering the difference in RF margin. |
| QC | We would be ok to consider re-using the LAA RSSI measurements as baseline but postpone the decision to next meeting. Can HW also elaborate why do we only consider 15 dB as relaxation.  |
| Nokia, Nokia Shanghai Bell | Agree to the proposal. Some relaxed margin can be considered for FR2.  |

**Issue 2-1-3: Measurement accuracy for extreme condition and high Io**

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| --- | --- |
| **Company** | **Comments** |
| LG | We are fine for option 1. |
| QC | We are fine with the first two bullet points which are aligned with intra-freq RSRP measurements . However, for extreme condition with Io=-50dBm/BW we would also like to keep the same alignment and add 3/3/dB for FR1/FR2 |
| Nokia, Nokia Shanghai Bell | Agree to the proposal.  |

**Sub-topic 2-2 : CLI performance test case**

**Issue 2-2-1 and Issue 2-2-2: Test case list and sub-tests for measurement accuracy**

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| --- | --- |
| **Company** | **Comments** |
| LG | Define event triggered reporting test cases and measurement accuracy test casesFor sub-test, we can consider option 1 as starting point. |
| QC  | I am trying to understand why we do we need two test cases for delay in CLI. Only non-DRx should be enough here.  |
| Nokia, Nokia Shanghai Bell | Agree to define the test cases in SA FR1 and SA FR2. More discussion is needed for EN-DC.  |
| LG | For QC’s comment I think that most use cases of CLI measurements will be non-DRX, but CLI measurement on DRX could be performed from the specification perspective.For Nokia’s comment EN-DC is not preclude in CLI feature. |

**Issue 2-2-2 ~ Issue 2-2-6: Test configuration**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| LG | We prefer to use each option for Issue 2-2-2~2-2-5.For Issue 2-2-6, we prefer AoA Setup#1.In this online meeting, we need to make agreement as many test parameters for CLI performance test cases as possible to prepare initial draft CRs in the next meeting. |
| Huawei, HiSilicon | Support option 1 in each of Issue 2-2-3 ~ 2-2-6. |
| QC | Issue 2-2-2- Issue 2-2-4: We are fine with option 1Issue 2-2-5: Need more timeIssue 2-2-6: We would like to do these tests with 2 AoA since that represents a more realistic scenario as would be seen in the field.  |
| Nokia, Nokia Shanghai Bell | We can reuse existing configuration if available. For the new conditions/configuration values, more discussion is needed.  |
| LG | It seems to be agreeable For Issue 2-2-2 ~ 2-2-4.For AoA setup,  UE does not need to sweep Rx beam for CLI measurement, so AoA setup#1 is enough to verify performance test. |

**Sub-topic 2-3 : Minimum SRS RP**

**Issue 2-3-1: Minimum SRS\_RP**

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| **Company** | **Comments** |
| LG | If these values are agreeable, we will prepare CR in this online meeting. |
| Huawei, HiSilicon | Support option 1. |
| QC | We are fine with option 1 too.  |
| Nokia, Nokia Shanghai Bell | Agree. |
| LG | Thanks, I’ll share draft version. |

### 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** |
| R4-2001624 | LG : pending until Issue 2-1-1~2-1-3 are clear.  |
| Nokia, Nokia Shanghai Bell: It can be done after we agree with the accuracy values. |
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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.*

|  |  |
| --- | --- |
|  | **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*

|  |  |
| --- | --- |
| **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”* |