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

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

**Agenda item:** 6.3

**Source:** Moderator (ZTE Corporation)

**Title:** Email discussion summary for RAN4#94e\_#2\_NR\_NewRAT\_SysParameters

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion and provide some guidelines for email discussion if necessary.*

This email thread is assigned to discuss issues related to Rel-15 system parameters maintenance.

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

* 1st round:
	+ Collect understanding and views of each company on the listed open issues
		- If there is an unanimous understanding on one issue after collection, the issue will be removed from the open issues.
	+ Discussion aiming to aligned understanding
* 2nd round: TBA

# Topic #1: Add 30 kHz SCS for n40 SSB

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000193 | Huawei | Proposal: to address the misalignment between SSB SCS configuration and data SCS configuration when 30KHz data SCS is configured for Band n40, the following alternative solutions are proposed:• Alt#1: Add 30KHz SSB SCS in the synchronization raster configuration for n40 from Rel-15• Alt#2: Add 30KHz SSB SCS in the synchronization raster configuration for n40 from Rel-16, and check the feasibility of Rel-16 network supporting both 15KHz SSB SCS and 30KHz SSB SCS. • Alt#3: Define a new band with the same frequency range as n40 and reusing the same RAN4 requirements and add 30KHz SSB SCS for it.--------------------------------------------------------------Observation 1: Enabling 30KHz SCS for n40 SSB can improve the spectrum efficiency by saving the guard bands between SSB with 15KHz SCS and data with 30KHz SCS when 30KHz SCS is used.Observation 2: The UE capability of simultaneous reception of SSB and data with different numerologies is optional, and without supporting that capability the longer measurement time, the more frequent interruptions on the service and more scheduling restrictions will be expected.Observation 3: To support the simultaneous reception of SSB and data with different numerologies will result in the increasing complexity for UE, BS and test equipment, which would delay the deployment for n40.Observation 4: Adding 30KHz SCS for n40 SSB could lead to the tolerable additional delay for initial access, which is comparable to the initial access delay for the bands which support both 15KHz and 30KHz SCS SSB.Observation 5: if there was or was going to be no n40 device in the market, it could be feasible to add 30KHz SCS for n40 SSB from Rel-15. |

## Open issues summary

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

The main motivation of the issue comes from the intention of avoiding a configuration of different SCSs between SSB and data, i.e., to align the SCS between SSB and data. This sub-topic is to align understanding within the group on the necessity of adding 30kHz SCS for n40 SSB, which is fundamental to decide whether or not to introduce the new SCS for n40 SSB into specs.

Notes:

* The below issue 1-1 and 1-2 are for non-CA case, and 1-3 s for CA case, and please keep in minds that these issues are generic, not only to n40.
* Issue 1-4 is n40 specific.
* If adding 30k SCS for n40 SSB, it is obvious that the searching time will be increased during initial access, thus this is not listed.

### Sub-topic 1-1

*Sub-topic description:*

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

**Issue 1-1: Is additional specs change required to address the case where SSB and data have different SCSs?**

* Views
	+ View 1: Yes, it can be at least 4 PRBs on each side of SSB
	+ View 2: No, up to implementation according to current specs “inter-numerology guard band within the carrier is implementation dependent”

### Sub-topic 1-2

*Sub-topic description*

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

**Issue 1-2: In addition to potential guard-band, what would be other consequences if SSB and data is configured with different SCSs? And is any standardization efforts/correction required?**

* Views
	+ View 1: Long interruption and downlink throughput loss, and increased implementation complexity for BS, UE and test equipment, so the specs shall ensure that the same SCS of both SSB and data be supported for all supported SCSs in each band.
	+ View 2: Implementation dependent only, and already addressed in the current specs via different capability signalling. No more specs change required.

**Issue 1-3:** **Does *supportedSubCarrierSpacingDL* indicate both SSB and data in NR CA? For example, in an inter-band CA configuration, if CC#1 is configured with a 15k SCS SSB and 30k SCS data, and CC#2 is configured with a 30k SCS SSB and 30k SCS data, is the configuration supported by the current specs without the capability of simultaneous reception with different numerologies in CA?**

* Views
	+ View 1: both SSB and data, and the example is not supported if the capability of simultaneous reception with different numerologies in CA.
	+ View 2: only refer to data, and the example is supported because the data SCS of both CCs are the same.

### Sub-topic 1-3

*Sub-topic description*

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

**Issue 1-3:** **Does *supportedSubCarrierSpacingDL* indicate both SSB and data in NR CA? For example, in an inter-band CA configuration, if CC#1 is configured with a 15k SCS SSB and 30k SCS data, and CC#2 is configured with a 30k SCS SSB and 30k SCS data, is the configuration supported by the current specs without the capability of simultaneous reception with different numerologies in CA?**

* Views
* View 1: both SSB and data, and the example is not supported if the capability of simultaneous reception with different numerologies in CA.
* View 2: only refer to data, and the example is supported because the data SCS of both CCs are the same (30k).

### Sub-topic 1-4

*Sub-topic description*

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

**Issue 1-4:** **Is there any NBC issue for Rel-15 if adding 30k SCS for n40 SSB? And what could be the solution to solve if yes?**

* Views
* View 1: No
* View 2: Yes, add 30k SCS for n40 SSB from Rel-16
* View 3: Yes, define a mirror band supporting 30k SCS SSB from Rel-16

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |
| CMCC | Sub topic 1-1 (Issue 1-1): We think “View 2” is better. In the case that SSB and data have different SCSs, the guard band can leave to implementation.Sub topic 1-2 (Issue 1-2): It is not clear whether there is any standardization efforts required if SSB and data is configured with different SCSs. Our understanding is that the current spec can support mix numerology. But from practical deployment perspective, it is better to use the same SCS for SSB and data in order to get better performance. Sub topic 1-3 (Issue 1-3): Our understanding is that ***supportedSubCarrierSpacingDL*** only indicate data for CA. But there is another UE capability ***simultaneousRxDataSSB-DiffNumerology***, which indicates whether UE supports concurrent intra-frequency measurement on serving cell or neighbouring cell and PDCCH or PDSCH reception from the serving cell with a different numerology. This capability will have impact on the performance if 15K SCS SSB and 30KHz SCS data are deployed.Sub topic 1-4 (Issue 1-4): Based on our knowledge, there is no UE supporting n40 so far. We prefer to add 30KHz SSB SCS in Rel-15 (Veiw 1).  |
| CATT | Sub topic 1-1 In our view, the guard band between SSB and data with different SCS is an implementation issue.Sub topic 1-2: From implementation complexity and performance point of view, we prefer to support same numerology between SSB and data as much as possible.Sub topic 1-3: Same view as CMCC.Sub topic 1-4: If there is no Rel-15 UE developed for Band n40. We prefer to add 30kHz SSB from Rel-15. |
| ZTE | Sub topic 1-1 We have similar view as CMCC and CATT, additional changes for spec are no need. It is an implementation issue.Sub topic 1-2: In my understanding, mix numerology is supported in current spec and it is band agnostic. Usually the introduction of new SSB SCS is pending on the operator. Similar view as CMCC, it is better to use the same SCS for SSB and data in order to get better performance.Sub topic 1-4: If there are similar situation for the other bands in future. How to treat?  |
| Qualcomm | Sub topic 1-1 (Issue 1-1): We agree with view 2. Standardizing a guard band for different numerologies was discussed in Rel.15 time frame and agreement was to leave it to implementation. We do not think anything has changed since then such that this is now needed.Sub topic 1-2 (Issue 1-2): We agree with view 2, nothing is needed from a specification point of view. This scenario is supportedSub topic 1-2: (Issue 1-3) supportedSubCarrierSpacingDL is for data SCS, support of 15kHz and 30kHz SCS for SSB should be mandatory. Whether there is a need for any additional capabilities or IOdT bits should be further discussed. ***simultaneousRxDataSSB-DiffNumerology*** indicates if UE supports concurrent measurements and data reception with different numerology. This capability would be needed to avoid interruptions caused by measurement gaps configured for intra-frequency measurements. Sub topic 1-4(Issue 1-4): There will be backwards compatibility issues if 30kHz SSB SCS is added from Rel.15. Addition only from Rel.16 could also cause issues in the field. It is not clear why a new band would be needed since the specifications support the deployment scenario needed. |
| vivo | We have a few questions about Topic 1:The misalignment between SSB SCS configuration and data SCS configuration, is it a general issue for all NR operating bands with only 15kHz SSB SCS or a specific issue only existing in band n40?If this is a general issue, why only add 30kHz SSB SCS for band n40? How about other bands with the same issue?[Huawei]: the other band with the similar issue is n50. For the other re-farming bands, there would be no issue.Sub topic 1-1: From our perspective, “View 2” matches the current spec.Sub topic 1-2:’View 1’ restricts too much for each band ensuring the same SCS between SSB and data. We prefer to ‘View 2’Sub topic 1-3: For the basic NR CA operation, only data channels across CCs have SCS restrictions. So we support ‘view2’.Sub topic 1-4: We share the same view with CATT and CMCC. |
| Huawei | **Sub topic 1-1:**The guard band is needed because that the sub-carriers of SSB with 15KHz SCS is not orthogonal to the sub-carriers of data with 30KHz SCS, which causes the interferences between SSB with 15KHz SCS and data with 30KHz SCS. And in the practical network, the PSD on SSB and data would be also different depending on the beam forming used for them to fulfill the need of coverage. Because the different companies will utilize the different PSD difference between SSB and data, it is difficult to specify the guard band in-between SSB and data. According to our implementation, 4PRB seems a reasonable value for some case. We have no proposal to define guard band, as it is specified that *inter-numerology guard band within the carrier is implementation dependent*. We do not propose it. Besides, 4RPB guard band does not contradict with the specification or agreement.**Sub topic 1-2:** Issue 1-2: Issues for SSB and data configured with different SCSs have been discussed. And the standardization work was done.For n40, 15KHz SCS SSB only causes some difficulty in the implementation especially for the case where 30KHz data SCS is used. So we prefer to add 30KHz SSB SCS.**Sub topic 1-3:**Issue 1-3: ***supportedSubCarrierSpacingDL*** is for subcarrier spacing used in this BWP for all channels and reference signals unless explicitly configured elsewhere.Both view 1 and view 2 are inaccurate. In case to save your time to look up the RAN2 specification, I copy it as below. -- ASN1START-- TAG-FEATURESETDOWNLINKPERCC-STARTFeatureSetDownlinkPerCC ::= SEQUENCE { supportedSubcarrierSpacingDL SubcarrierSpacing, supportedBandwidthDL SupportedBandwidth, channelBW-90mhz ENUMERATED {supported} OPTIONAL, maxNumberMIMO-LayersPDSCH MIMO-LayersDL OPTIONAL, supportedModulationOrderDL ModulationOrder OPTIONAL}-- TAG-FEATURESETDOWNLINKPERCC-STOP-- ASN1STOP***subcarrierSpacing***Subcarrier spacing to be used in this BWP for all channels and reference signals unless explicitly configured elsewhere. Corresponds to subcarrier spacing according to TS 38.211 [16], table 4.2-1. The value *kHz15* corresponds to µ=0, value *kHz30* corresponds to µ=1, and so on. Only the values 15 kHz, 30 kHz, or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable. For the initial DL BWP this field has the same value as the field *subCarrierSpacingCommon* in *MIB* of the same serving cell.Our point is that the feature of support of simultaneous reception of with different numerolgoies in CA for other cases, is optional. So for some CA combination, if 30KHz data SCS is used for PCell with larger channel bandwidth, the 30KHz data SCS should be used for other SCell on band n40 not matter what channel bandwidth is configured on carrier of n40, i.e., even smaller channel bandwidth. We just want to show the case where 30KHz data SCS is more preferable.The signaling referred by CMCC is clearer. We just refer to a sentence under the box of supportedSubCarreirSpacingDL.In our paper, we also provide other cases where 30KHz data SCS on n40 is more suitable. In other words, there are many scenarios where 30KHz data SCS is more easy-to-use.**Sub topic 1-4: No reference for either views. Agree with CMCC, CATT**We have already provided our analysis on the NBC issue. There is no impact on ASN.1. It depends on whether there is a legacy UE on market now. We encourage companies to think it from implementation point of view. 2.3GHz would become popular in future. And according to our analysis 30KHz data SCS is more preferable in the practical use case. It would be useful to reduce some complexity and ensure the system performance with 30KHz data SCS.As we said in our paper, there would be some benefits:1. Since the simultaneous measurement and reception of data with different numerologies is optional feature, the 30KHz SSB is more reasonable to ensure the shorter measurement delay.
2. The guard band between SSB with 15KHz SCS and data with 30KHz SCS can be saved.
3. Even test equipment could only support the same numerology on data and SSB. If 30KHz is supported, then it is more easy to get TE. Otherwise, we need wait for a while.
 |

### 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** | *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**  |
| R4-2000194 TS38.101-1 CR: adding 30KHz SSB SCS for n40, Huawei | *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: Redundant sentence for the intraband EN-DC channel spacing

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000489 CR to TS 38.101-3: Correct the intra-band ENDC channel spacing | ZTE Corporation | Proposal : remove the redundant sentence:For NR operating bands with 15 kHz channel raster,~~Nominal Channel spacing = (BWE-UTRA\_Channel + BWNR\_Channel)/2+{-5kHz, 0kHz, 5kHz}~~ - Nominal Channel spacing = (BWE-UTRA\_Channel + BWNR\_Channel)/2+{-5kHz, 0kHz, 5kHz} for ∆FRaster equals to 15 kHz- Nominal Channel spacing = (BWE-UTRA\_Channel + BWNR\_Channel)/2+{-10 kHz, 0 kHz, 10 kHz} for ∆FRaster equals to 30 kHz |
|  |  |  |

## 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

*Sub-topic description:*

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

**Issue 2-1: Redundancy confirmed**

* Views
	+ View 1: Yes
	+ View 2: No

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | Sub topic 2-1: We suggest View2. |
| Nokia | View 1 |
| ZTE | In RAN4#92 meeting, it was agreed that the equations for NR operating bands with 15 kHz channel raster in TS38.101-1 were corrected related to ∆FRaster (i.e. 15 kHz and 30kHz.). For TS38.101-3, it shall be aligned with 38.101-1. Actually, we have submitted the CR to TS38.101-3 to correct the equations aligned with 101-1 in RAN4 #93 meeting and the CR was approved. However, the CR was wrongly reflected in the lastest 101-3 spec. Hence it is need to remove the redundant sentence in 101-3. |

### 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion 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 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 #2: Wording and reference correction for CA channel spacing

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001783 CR for 38.101-1 channel space for CA\_Rel15, R4-2001785 CR for 38.101-2 channel space for CA\_Rel15 | Huawei, HiSilicon | Proposal 1: Add “common” to µProposal 2: Referring to Table 5.3.2-1 instead of 5.3.5-1 |
|  |  |  |

## 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

*Sub-topic description:*

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

**Issue 2-1: Necessity to add “common” to µ**

* Views
	+ View 1: Yes, more clear
	+ View 2: No, it is clear enough for the current wording “μ0 is the common largest μ value among the subcarrier spacing configurations supported in the operating band for both of the channel bandwidths”

### Sub-topic 2-2

*Sub-topic description*

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

**Issue 2-2: which is preferred, Table 5.3.5-1 or Table 5.3.2-1?**

* Views
	+ View 1: Table 5.3.5-1 as it is now, since this allows for band specific definition.
	+ View 2: Table 5.3.2-1 as proposed, since it applies to all bands.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 2-1: Skyworks: the overall definitions of the channel spacing, guard bands are measurement bandwidth is also discussed within Thread #18 for NR UL intra-band contiguous CA. we believe an consistant specification and notation is needed throughout. We could agree to proposed CR once the overall view is consistent and shared amongst companies. We anyhow agree that current spec wording needs clarification. For which table to refer to, I believe it is ambiguous since the raster is defined in one table and the common largest mu in another.ZTE: It seems misunderstanding exist among companies since some discussion on the measurement channel bandwidth of ACLR in #18. In thread #18, company also provide the proposals on how to improve this sentence, hence it shall be discussed together. Sub topic 2-2:….ZTE: The original table (i.e. Table 5.3.5-1) is better. The table 5.3.2-1 is for all band. However, we should consider the supported SCS for the channel bandwidth supported for a certain band for intra-band CA operation. For example, for band n5 operated in intra-band CA. According to Table 5.3.5-1, 60kHz is not supported for all the channel bandwidths supported in band n5, so *μ0* is 1 (SCS=30kHz) for 10M+10M CA. However, *μ0* may be interpreted as 2 (SCS=60kHz) according to table 5.3.2-1 since 60kHz SCS is supported for 10MHz.Others: |
| Qualcomm | Sub topic 2-1: We agree with view 2, the change is not needed. Wording is already clear enough, adding common would make the text redundantSub topic 2-2: we agree with view 1, no change is needed. |
| Huawei | Sub topic 2-1: common wording is we have agreed in the WF approved in RAN4 #91 meeting, we suggest to follow the exact description in the approved WF. We don’t want to have misunderstanding for audiences of TS 38.101.Sub topic 2-2: it is a necessary change because table 5.3.5-1 is updated with each version of TS 38.101, but the UE cannot adjust the table accordingly. Table 5.3.2-1 is relative fixed. Nominal channel space is just a reference space for UE and gNB verify the contiguous issue, the information from table 5.3.5-1 on calculating nominal channel space is redundant. |
| Nokia | Support Skyworks WF to further check the issue. |

### 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** | *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*

|  |  |
| --- | --- |
| **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”* |