**3GPP TSG-RAN WG4 Meeting # 98-e R4-2103929**

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

**Agenda item:** 7.4.1, 7.4.2

**Source:** Moderator (CATT)

**Title:** Email discussion summary for [98e][305] NR\_IAB\_RF\_Maintenance

**Document for:** Information

# Introduction

The email thread [98e] [305] NR\_IAB\_RF\_Maintenance covers the contributions in agenda 7.4.1 and 7.4.2. The targets of the two rounds are as following.

* 1st round:
  + Discuss the open issues to find the tentative WF.
  + Review the maintenance CRs to collect comments.
* 2nd round:
  + Approve the WF for the open issues or agree the related CRs.
  + Agree the maintenance CRs.

# Topic #1: Open issues for maintenance

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100365 | CATT | **Proposal 1: IAB-MT EVM measurement process refers UE R15 specification.**  **Proposal 2: IAB-MT EVM only test PUSCH physical channel and the measurement process doesn’t include the description of other physical channels/signals.**  How to update the spec is also provided to collect comments. |
| R4-2100826 | CMCC | **Proposal 1: the diagram for IAB-MT EVM measurement methodology is suggested below by replacing the block** **“Tx-Rx chain equalizer” with block “Per-subcarrier Amplitude/phase and CPE correction” and by eliminating block “in-band emission meas”, based on UE measurement points. It is noted, the CPE correction is only used in FR2 not FR1.**    **Proposal 2: For IAB-MT it is better to calculate phase and magnitude of original Tx signal in 10ms time-averaging length without any frequency domain linear interpolation when measuring EVM.**  **Proposal 3: For averaged EVM, it is more preferred to reuse the same averaging period as UE over basic EVM considering IAB-MT acts as UE.** |
| R4-2102012 | Nokia, Nokia Shanghai Bell | **Proposal 1: Usage of PT-RS should be enabled in Tx EVM conformance test for IAB-MT to be aligned with Tx EVM test for gNB.** |
| R4-2102333 | Ericsson | **Proposal-1: Specify BS approach on EVM measurement procedure**.  **Proposal-2: Allow the configuration of the PTRS signal in the IAB-MT TX test signal but optional.** |
| R4-2102334 | Ericsson | **Observation-1: Compared with UE characteristic of interference signal specification, the bandwidth and # of RB are specified in core specification in IAB-MT and thus there is no need to be specified again in Annex.**  **Observation-2: Interference signal other detailed configuration is chosen as the same as the wanted signal in UE specification.**  **Proposal -1: IAB-MT interference signal construction could be the same as the wanted signal as one option.**  **Proposal-2: For the detail configuration design of interference signal design, RAN4 could discuss it after consensus on wanted signal design (test model).** |

## Open issues summary and views’ collection for 1st round

### Sub-topic 1-1

**Issue 1-1: Does IAB-MT EVM measurement procedure refer UE spec or follow BS procedure?**

* Proposals
  + Option 1: Refer UE R15 spec with some necessary modifications. (CATT)
  + Option 2: The same as BS approach. (Ericsson)
* Recommended WF
  + Option 1

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| **Company** | **Comments** |
| Ericsson | Option 2. As indicated in 2333, the BS approach does not prevent the usage of the UE TE while it not the other way round. |
| Huawei | Option 2 |
| Qualcomm | UE approach seems simpler, will enable most reuse. |
| Nokia, Nokia Shanghai Bell | Option 2. It seems that when the necessary modifications are done to UE R15 specification the results is very close to BS approach. |
| CATT | We still think option 2 is not technically correct. The most differences for option 1 and option 2 are still the physical channel differences. BS Tx signal doesn’t support SC-FDMA and the REFSENS signal is not same for UL and DL, thus the channel equalizer calculation method for BS is not correct for UE. |

------------------------------ **GTW Notes for Jan.26th (45 minutes) –Email thread 305) -----------------------------------**

**Issue 1-1: Does IAB-MT measurement procedure refer UE spec or follow BS procedure?**

* Proposals
  + Option 1: Refer UE R15 spec with some necessary modifications. (CATT)
  + Option 2: The same as BS approach with some necessary modifications if needed. (Ericsson, Nokia, ZTE)
* Recommended WF
  + Option 1

Discussion:

CATT: With option 2, we believe BS approach, there are many delta compared to IAB-MT, these required lots of changes i.e. equalizer .

Nokia: We prefer option 2, both options required the modifications; in the end the output will be same. We prefer to align DU and MT as much as possible. We think option 2 may no need modifications.

E///: We make some analysis between UE like or BS like approach, we believe no changes needed using BS approach.

The TE for BS conformance can be reused without modifications.

ZTE: We prefer option 2, but we have some different understanding for the necessary changes with BS approach. It’s premature to conclude now. The configurations i.e. physical channels etc.

CATT: We already discussed several meetings, we need to conclude right now. But we would like to further discuss the details to understand which parts need to be modified.

Agreements:

Using BS approach as basis, further discuss on the details required and the modifications not precluded if necessary

### Sub-topic 1-2

**Issue 1-2: If all of the UL physical channels should be tested for IAB-MT EVM measurement?**

* Proposals
  + Option 1: only PUSCH is tested (CATT)
  + Option 2: Following UE that PUSCH, PUCCH, DMRS and PRACH should be tested.
  + Option 3: Other proposal
* Recommended WF
  + Option 1

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| **Company** | **Comments** |
| Ericsson | Option 1. EVM measure the hardware impairment. Follow the BS approach which not test all different physical channel is ok. |
| Samsung | Support recommended WF |
| Huawei | Option 1 is ok |
| Qualcomm | Option 1 is ok. |
| Nokia, Nokia Shanghai Bell | Similar to base station EVM, it is not necessary to separate channels. |
| CATT | Option 1. |

------------------------------ **GTW Notes for Jan.26th (45 minutes) –Email thread 305) -----------------------------------**

**Issue 1-2: If all of the UL physical channels should be tested?**

* Proposals
  + Option 1: BS approach (CATT, ZTE, Samsung, Ericsson, Nokia, Huawei)
  + Option 2: Following UE that PUSCH, PUCCH, DMRS and PRACH should be tested.
  + Option 3: No need to describe physical channel in EVM measurement procedure in core spec, Test modes will be introduced in conformance spec (Nokia)
* Recommended WF
  + Option 1

Discussion:

Nokia: We have core requirements for averaging EVM, no separate for individual physical channels. We will introduce test modes for requirements.

ZTE: We prefer option 1.

Samsung: we support option 1, we can use BS spec approach to update IAB core spec, EVM (modulation schemes) only specified for PDSCH.

E///: We support option 1 with BS approach.

QC: How to ensure DMRS performance as receiver need to use DMRS for decoding?

Nokia: we are fine with BS approach. For DMRS should not have impact the performance in the end.

QC: For UE side, we verify everything.

E///: From performance wise, existing BS approach already verified it works.

Huawei: We prefer to verify PUSCH only.

Agreement:

Using BS approach:

1. Core spec: clarify that the EVM (modulation orders) specify for PUSCH
2. Introduce test modes in conformance spec with PUSCH channel

### Sub-topic 1-3

**Issue 1-3: Should PTRS be used for IAB-MT EVM measurement?**

* Proposals
  + Option 1: yes for FR2 and optional (Nokia, Ericsson)
  + Option 2: No, as the current UE spec
* Recommended WF
  + Option 1

*Moderator: It’s moderator’s understanding that the proposal is for FR2 not FR1.*

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| **Company** | **Comments** |
| Ericsson | Option 1. |
| Samsung | Ok with option 1. But would like to clarify whether optional will have impact on spec. |
| Huawei: | Option 1 |
| Qualcomm | Why is PT-RS needed, isn’t DMRS enough? |
| Nokia, Nokia Shanghai Bell | Option 1 |
| CATT | Option 1 is ok. |

------------------------------ **GTW Notes for Jan.26th (45 minutes) –Email thread 305) -----------------------------------**

**Issue 1-3: Should PTRS be used IAB-MT EVM measurement?**

* Proposals
  + Option 1: yes for FR2 and optional (Nokia, Ericsson, Samsung,ZTE,Huawei)
  + Option 2: No, as the current UE spec
* Recommended WF
  + Option 1

*Moderator: It’s moderator’s understanding that the proposal is for FR2 not FR1.*

Discussion:

QC: Why DMRS not enough? In real NW, we can’t guarantee PTRS always configured.

Samsung: What’s the meaning for optional? Declaration basis?

E///: In FR2 EVM measurement procedure for BS, PTRS can be configured optional.

ZTE: FR2 PTRS is key and considering future with further extending frequency ranges PTRS also important. Current in BS FRC, PTRS also exists.

Nokia: Having PTRS in FR2 optional aligned with BS spec.

Huawei: We support option 1. We can use same BS approach.

Agreement:

Follow BS approach to configure PTRS in FR2 with optional

Further discuss the test model and how to the clarify the optional in conformance specification if needed

### Sub-topic 1-4

**Issue 1-4: How to modify IAB-MT EVM measurement diagram?**

* Proposals
  + Option 1: As proposed in R4-2100365 (CATT)
  + Option 2: As proposes in R4-2100826 (CMCC)
  + Option 3: As BS diagram (Ericsson)
  + Option 4: Other proposal
* Recommended WF
  + To be discussed

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| **Company** | **Comments** |
| Ericsson | Option 3. |
| Samsung | Firstly there is no need to provide detail architecture for DUT. And the diagram similar to BS EVM are preferred as for IAB node verification on both CP-OFDM and DFT-s-OFDM seems redundant. |
| Huawei | Depends on the decision of sub-topic 1-1 to some extent. But option 3 seems consistent with our view on this. |
| Qualcomm | Depends on 1-1, should be inline with that decision |
| Nokia, Nokia Shanghai Bell | This can be discussed after there is alignment on sub-topic 1-1. The modifications in option 1 result in very similar outcome as option 3. Our preference is option 3. |
| CATT | Agree that when 1-1 is decided, this discussion will be easier. |

------------------------------ **GTW Notes for Jan.26th (45 minutes) –Email thread 305) -----------------------------------**

**Issue 1-4: How to modify IAB-MT measurement diagram?**

* Proposals
  + Option 1: As proposed in R4-2100365 (CATT)
  + Option 2: As proposes in R4-2100826 (CMCC)
  + Option 3: As BS diagram (Ericsson)
  + Option 4: Other proposal
* Recommended WF
  + To be discussed

Discussion:

CATT: Using BS diagram as basis, further modifications not precluded.

E///: EVM should be same BS and UE including reference points with different methodologies.

Agreements:

Using BS diagram as basis, further modifications not precluded if necessary.

### Sub-topic 1-5

**Issue 1-5: The equalizer calculation method and time interval for IAB-MT EVM measurement**

* Proposals
  + Option 1: No frequency domain linear interpolation and 10 ms (CMCC)
  + Option 2: The same as BS (Ericsson)
  + Option 3: The same as UE (CATT)
  + Option 4: Other proposal
* Recommended WF
  + To be discussed

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| **Company** | **Comments** |
| Ericsson | Option 2. |
| Samsung | Would like to understand if different parameter and method designed for IAB-MT and IAB-DU whether it is still possible to restrict the test burden? |
| Huawei | Option 2 |
| Qualcomm | Option 3 should be simplest |
| Nokia, Nokia Shanghai Bell | Option 2 |
| CATT | The reference signals difference for DL and UL make option 2 can’t be used. If only IAB-MT transmit DL signal, option 2 can be chosen. So still think from technical point, the same as UE is the correct approach. |
| Keysight | As TE vender, we have strong preference to use existing equalizer definition as is, in other words, no modification preferred. With this, for IAB-MT to measure UL signal EVM, use UE equalizer definition.  I’d like to avoid situation which no appropriate modification is not available from TE vender when Device vender like to makes measure.  Option 3 |

### Sub-topic 1-6

**Issue 1-6: The basic EVM measurement interval for IAB-MT**

* Proposals
  + Option 1: The same as UE for PUSCH (10 ms) (CATT)
  + Option 2: The same as UE (CMCC)
  + Option 3: The same as BS (Ericsson)
* Recommended WF
  + To be discussed

*Moderator: The discussion of this topic may rely on the conclusion of Issue 1-2. If the conclusion is that only PUSCH is measured for IAB-MT, all of the three options go to 10 ms.*

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| **Company** | **Comments** |
| Ericsson | Option 3. UE and BS both has 10ms measurement inverval for DATA. Addtionaly UE also has 60 subframe for reference signal so it also depends on which physical channel EVM IAB-MT should be tested. If only PUSCH is needed which is to follow BS approach. |
| Huawei | We support option 1 in sub-topic 1-2 (PUSCH only) so 10ms option is ok |
| Qualcomm | Option 1 |
| Nokia, Nokia Shanghai Bell | Option 3 |
| CATT | Maybe we can agree 10 ms to let the discussion easier. |
| Keysight | Option 1 |

------------------------------ **GTW Notes for Jan.26th (45 minutes) –Email thread 305) -----------------------------------**

**Issue 1-6: The basic EVM measurement interval (if time allowed)**

* Proposals
  + Option 1: The same as UE for PUSCH (10 ms) (CATT)
  + Option 2: The same as UE (CMCC)
  + Option 3: The same as BS (Ericsson)
* Recommended WF
  + To be discussed

Discussion:

Agreements: The same as BS approach.

### Sub-topic 1-7

**Issue 1-7: IAB-MT interference signal construction spec**

* Proposals
  + Proposal in R4-2102334 (Ericsson): One option is to configure the interference signal as the same as wanted signal but detail is decided after the conclusion of DL FRCin conformance test. Below text is recommended.

*The interfering signal shall be configured with PDSCH and PDCCH containing data and DM-RS symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 6 of TS38.211 [9]. Mapping of PDSCH modulation to receiver requirement are specified in table F-1.*

Table F-1: Modulation of the interfering signal

|  |  |
| --- | --- |
| Receiver requirement | Modulation |
| Adjacent channel selectivity and narrow-band blocking | QPSK |
| General blocking | QPSK |
| Receiver intermodulation | QPSK |

* Recommended WF
  + To be discussed

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| **Company** | **Comments** |
| Ericsson | The text proposal does not give detail of the construction of the interference signal which follows the BS approach. |
| Samsung | Fine with the general way recommended to provide the interfering signal type. |
| Nokia, Nokia Shanghai Bell | The proposed text seems mostly good and aligned with what is used in TS 38.141-1/2. As the interfering signal is downlink signal, the text should refer to clause 7 of TS 38.211. |

## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2100366, Draft CR for TS 38.174: IAB-MT EVM measurement, CATT | Nokia, Nokia Shanghai Bell: We should discuss the sub-topics first. As of now, we prefer the CR from Ericsson in R4-2102337. |
| Ericsson: cannto decide now, depending on the 1st round discussion |
| R4-2100367, Draft CR for TR 38.809: IAB-MT EVM measurement, CATT | Nokia, Nokia Shanghai Bell The TP to TR needs to be aligned with the agreements in this sub-topic. We do not support this TP as we think adopting UE requirements is not the correct approach. |
| Ericsson: cannot decide now, depending on the 1st round discussion |
| R4-2102337, CR on Transmitted signal quality in TS 38.174 , Ericsson |  |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#1** | After the email discussion and the GTW discussion, the following high level agreements were reached,  **Issue 1-1: Does IAB-MT EVM measurement procedure refer UE spec or follow BS procedure?**  Using BS approach as basis, further discuss on the details required and the modifications not precluded if necessary  **Issue 1-2: If all of the UL physical channels should be tested for IAB-MT EVM measurement?**  Using BS approach:   1. Core spec: clarify that the EVM (modulation orders) specify for PUSCH 2. Introduce test models in conformance spec with PUSCH channel   **Issue 1-3: Should PTRS be used for IAB-MT EVM measurement?**  Follow BS approach to configure PTRS in FR2 with optional  Further discuss the test model and how to the clarify the optional in conformance specification if needed  **Issue 1-4: How to modify IAB-MT EVM measurement diagram?**  Using BS diagram as basis, further modifications not precluded if necessary.  **Issue 1-6: The basic EVM measurement interval for IAB-MT**  The same as BS approach.  The Issue 1-5: The equalizer calculation method and time interval for IAB-MT EVM measurement was not discussed in GTW meeting. And there were two different views in the 1st round email discussion. The discussion should be continued in the WF of 2nd round.  For the Issue 1-7: IAB-MT interference signal construction spec. The comments from companies showed it’s generally ok with some small errors which can be addressed in the revision of the corresponding CR.  **Recommendations for 2nd round:**  For issue 1-1 to 1-6: Further discuss WF to address the details of IAB-MT EVM measurement following the high level guideline that BS approach with some physical channel related modification is used.  For issue 1-7: Discuss the revision of the corresponding CR. |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | WF on IAB-MT EVM measurement in core spec | CATT |

### CRs/TPs

*It’s difficult to have the CR discussion without the agreements on the details, so moderator suggest to postpone the CRs to next meeting.*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2100366 | *Not pursued* |
| R4-2100367 | *Not pursued* |
| R4-2102337 | *Not pursued* |

## Discussion on 2nd round (if applicable)

R4-2103849 “WF on IAB-MT EVM measurement in core spec” was discussed in the 2nd round.

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| **Company** | **Comments** |
| *Company A* |  |
| *Company B* |  |
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**Comments collection**

## 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”* |
| R4-2103849 |  |

# Topic #2: Maintenance CRs

## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2100368, Draft CR for TS 38.174: Correction of clause 5, CATT | Ericsson: no need to mention this as the BW per band speaking itself. |
| Huawei: OK |
| CATT: Response to Ericsson: Thanks for the comments, there’s no BW per band table in TS 38.174. So still think clarification is needed. |
| R4-2100369, Draft CR for TS 38.174: Correction of clause 6,7 and 9, CATT | Ericsson: title of the 9.3 could be adding OTA in front of the IAB output power, not delete the IAB. |
| Huawei: As the title for BS is “OTA base station output power” and conducted is “IAB output power” then OTA IAB output power is probably the correct tittle. |
| CATT: Thanks for the comments. I will revise it in next version. |
| R4-2100909, Draft CR to align the general clause of radiated and conducted requirement, Samsung  *Moderator: The correction is included in R4-2102011.* | Samsung: fine to note this draft CR as covered by R4-2102011 |
| Nokia, Nokia Shanghai Bell: We support this change, and as moderator has noted, this change is included in R4-2102011 which does also an additional correction on the same issue for conducted requirements. Therefore, we’d prefer to go forward with R4-2102011. |
| Ericsson: ok |
| Huawei: ok but 2011 has additional correction so maybe use that |
| R4-2100910 Big CR for update on TR38.809, Samsung | Moderator’s note: This big CR is intended for email approval after the meeting. |
| R4-2102011, DraftCR to TS 38.174: Receiver requirement corrections, Nokia, Nokia Shanghai Bell | Ericsson :Ok |
| Huawei: ok |
| R4-2102336, CR on Tx Power related requirements in TS 38.174, Ericsson | Nokia, Nokia Shanghai Bell: this change is related to the discussion taking place for dynamic range test in thread [307]. Therefore, we should not move forward with this change before also the other discussion is concluded. Our understanding is that the traditional BS-like “total power dynamic range” applies for IAB-MT, but we are fine to align with the outcome of the discussion in [307]. |
| Huawei: is this not a test configuration issue? the core requirement should be valid for any fixed condition? |
| CATT: Agree that it should be discussed after there’s conclusion in [307] |
| R4-2102338, CR on Transmitter characteristics- Others, TS 38.174 Ericsson | Nokia, Nokia Shanghai Bell: The text should refer to clause 7 of 38.211, not to clause 6. |
| Huawei: depends on outcome of issue 1-7 |
| R4-2102339, CR on In-band selectivity and blocking requirements in TS 38.174, Ericsson | Huawei: ok |
|  |
| R4-2102340, CR on Rx Charateristic other related requirements, Ericsson | Nokia, Nokia Shanghai Bell: We are ok with the change, but there is an error in a table number in the middle of the added text. |
| Huawei: requirement ok, but it does introduce hanging text, I’m not sure if that can be avoided at this stage? Possibly add it as 10.6.4? |
| CATT: Agree with Huawei, the view from TS rapporteur is needed. |
| R4-2102341, CR on Sensitivity and dynamic range requirements TS 38.174, Ericsson | Huawei: ok |
|  |
| R4-2102422, draft CR to TR 38.174 - correction to clause 6, Huawei  *Moderator: The CR is for 38.809.* | Ericsson: ok |
| CATT: The tile of the contribution is not correct. We may need to ask MCC, should this contribution be revised or noted but asking a new Tdoc number. |

## Summary for 1st round

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2100368 | To be revised. |
| R4-2100369 | To be revised.  To address the comments from Ericsson and Huawei. |
| R4-2100909 | Not pursued.  The content is merged to R4-2102011 |
| R4-2100910 | For email approval after the meeting. |
| R4-2102011 | To be endorsed |
| R4-2102336 | Continue the discussion in 2nd round |
| R4-2102338 | To be revised.  To address the comments from Nokia. |
| R4-2102339 | To be endorsed |
| R4-2102340 | To be revised.  To address the comments from Nokia and contact with MCC or TS rapporteur on how to add the new clause to TS. |
| R4-2102341 | To be endorsed |
| R4-2102422 | To be endorsed  The Tdoc title will be updated as “draft CR to TR 38.809- correction” to clause 6 in both Tdoc list and the meeting report. |

## Discussion on 2nd round (if applicable)

The following CRs were discussed in the 2nd round,

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| **CR** | **Company** | **Comments collection** |
| R4-2103956 (from R4-2100368) | CATT | *Company A* |
| R4-2103850 (from R4-2100369) | CATT | *Company A* |
| R4-2102336 | Ericsson | *Company A* |
| R4-2103851 (from R4-2102338) | Ericsson | *Company A* |
| R4-2103852 (from R4-2102340) | Ericsson | *Company A* |

## 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”* |