**3GPP TSG-RAN WG4 Meeting # 100-e R4-2XXXX**

**Electronic Meeting, 16th – 27th August, 2021**

**Agenda item:** 5.1.10

**Source:** Moderator (Spirent)

**Title:** Email discussion summary for [100-e][203] NR\_NewRAT\_Positioning

**Document for:** Information

# Introduction

The document contains discussions for Rel-15 NR Positioning specs maintenance (36.171, 37.171 and 36.171)

The document contains the following two topics:

* Topic #1: Frequency Bands for testing of A-GNSS Sensitivity (AI 5.1.10.1)
* Topic #2: Others (AI 5.1.10.2)

# Topic #1: Frequency Bands for testing of A-GNSS Sensitivity (AI 5.1.10.1)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112138**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112138.zip) | Apple | Remaining issues on testing of A-GNSS Sensitivity requirements in NR and LTE (discussion) |
| [**R4-2113303**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113303.zip) | Xiaomi | Discussion on Frequency Bands for testing of A-GNSS Sensitivity requirements in NR and LTE (discussion) |
| [**R4-2114210**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114210.zip) | Qualcomm Incorporated | Frequency bands for testing of A-GNSS sensitivity requirements (CR 36.171) |
| [**R4-2114208**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114208.zip) | Qualcomm Incorporated | Frequency bands for testing of A-GNSS sensitivity requirements (CR 38.171) |

## Open issues summary

### Sub-topic 1-1: LTE and NR bands for testing

The WF from the previous meeting lists the following options:

*There are two options left for discussion:*

* + *Option 1: LTE Bands 13, 14, 24, 44 and NR Bands n13, n14, n24, n79 and n96. In case of the same LTE and NR band supported by a UE, e.g., 14/n14, it suffices to test either LTE band 14 or NR band n14 because of the same interference mechanism (Apple, Xiaomi, Qualcomm, vivo, OPPO)*
  + *Option 2: all UE supported bands (Spirent, R&S)*
* Proposal:
  + Apple: ***On LTE and NR bands for testing, select Option 1.***
  + Xiaomi: **option 1 is preferred.**
* Recommended WF
  + Discuss if Option 1 can be agreed.

### Sub-topic 1-2: EN-DC bands for testing

The follow agreement is reached in the WF in the previous meeting:

* + *When an EN-DC configuration generates second or third order intermodulation distortion (IMD) products falling into the following GNSS L1/E1/G1/B1 typical receiver bands (where supported by the UE), it shall be considered as a candidate for testing:*
  + *GPS L1 C/A : 1574.3970 – 1576.4430 MHz*
  + *Galileo E1 / GPS L1C: 1573.3740 – 1577.4660 MHz*
  + *GLONASS G1: 1597.5515 – 1605.8860 MHz*
  + *BDS B1I: 1559.0520 – 1563.1440 MHz*
  + *To further reduce testing, all EN-DC configurations are divided into groups with similar IMD level and risks. For each group, only one of the EN-DC configurations supported by the UE in the group shall be tested. Details can be found at Annex B of reference [1].*
* New Proposal #1:
  + Apple: ***Among the band combinations listed in Table 1 (see Tdoc*** [**R4-2112138**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112138.zip)***), prioritize those that generate both 2nd and 3rd IMDs and deprioritize those that only affect some (not all four) GNSS receiver bands for testing.***
* New Proposal #2:
  + Xiaomi: Only specify the IMD order for each group in the RAN4 spec and the detail test configuration for each band combination can be left to RAN5 with the guideline: The carrier frequencies and bandwidths for LTE band and NR band are selected such that the interference falls into the Rx of GNSS band.
* Recommended WF
  + Discuss if either or both New Proposal #1 and/or Proposal #2 should be added to the already agreed WF.

## Companies views’ collection for 1st round

### Open issues

**Sub-topic 1-1: LTE and NR bands for testing**

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| --- | --- |
| **Company** | **Comments** |
| AT&T | Option 2. The core requirements need to apply equally to all standalone operating bands. By selecting Option 2, we are not saying that devices will be tested in all UE supported bands. This is ultimately a decision for the certification bodies. We made very similar comments at RAN4 #99-e.  RAN4 should only provide information concerning the harmonic cases and where they exist to RAN5 and should not conclude that testing is only required in specific bands with harmonics (this is a RAN5 decision). RAN4 should highlight these cases but let RAN5 decide concerning the bands for test since RAN5 needs to address the needs of the certification bodies which can include a wider set of operating bands. In addition, operators in some regions are bound by regulatory requirements concerning positioning accuracy and need to ensure that UEs are compliant. It is critical that the RAN4 core requirements and RAN5 test cases cover other regional/national requirements and regulatory requirements when operating in the corresponding NR and/or LTE bands. As such, other frequency bands may need to be specified for testing.  Concerning the comment related to the case of the same LTE and NR band being supported by a UE, we believe that the RAN4 conclusion that the same interference mechanism exists can be communicated to RAN5. However, it is ultimately a RAN5 decision concerning test applicability in this case to decide if testing is done in LTE and/or NR. |
| DISH | Option 2. The core requirements need to apply, and equally as AT&T mentioned, to all SA bands.  Why is RAN4 deciding on what to test? This is a RAN5 decision. RAN4 can provide RAN5 with information as to what AT&T stated above.  To add on testing, RAN5 currently instruct only sensitivity tests to be tested on all bands. All the rest are sufficient with only one band supported by the UE. Single band testing, which much lower sensitivity requirements below -140dBm, is critical against some regulatory requirements, not to mention to verify the device RF performance against this low value.  We don’t fully understand why SA bands are in question here to begin with. The original issue in testing has been raised from the complexity EN-DC comes with, which is 10x fold compared to the number of supported bands by the UE. And even in EN-DC case, single band performance should be the baseline (irrespective of the harmonics), which again, is RAN5 scope. |
| Qualcomm | Option 1. We believe it is unnecessary to run the tests in a bearer band that is not affecting the GNSS reception bands. |
| Xiaomi | Option 1. To Dish, from the RAN5 LS(R5-206900), it is clear that SA bands is involved.  *RAN5 respectfully asks RAN 4 for guidance on the LTE and NR frequency bands, and band combinations, impacting the A-GNSS Sensitivity requirements in LTE and NR, and in particular in EN-DC, taking into account possible intermodulation and other interference mechanisms that may affect the GNSS bands.* |
| Spirent | Just some background:  The original main issue in RAN 5 was indeed the bands for EN-DC. The issue of bands for SA was only raised during the editing of the LS to RAN 4 and was, I believe, of lower importance to RAN 5. |
| Apple | Option 1.  First, regarding the applicability of core requirements in TS 38.171 as raised by AT&T and Dish, it is not clear from TS 38.171 that the core requirements apply to all the bands. If there is clear text about applicability in it, please let us know.  Second, even if we assume for a moment that core requirements would apply to all LTE/NR bands, RAN4 still can discuss and decide if some verification exemption can be granted and share such decisions with RAN5 (as the case for FR-2 requirements in TS 38.101-2), knowing that the whole discussion on tests was triggered by RAN5 LS asking for RAN4 views. Based on the analysis in RAN4, clearly there is no good technical justification that all bands need to be tested. |
| DISH | To Xiaomi. Yes, the ask is guidance on “*possible intermodulation and other interference mechanisms that may affect the GNSS bands.” and “In particular EN-DC”* So, let’s stick with the IMD and interference cases.  To Apple.  First, so you are saying these requirements do not apply across all bands? Further, this is exactly why RAN5 selects what testing should be done based on the minimum requirements.  Second, can you elaborate why and which FR2 requirements are the same as this. We don’t understand this comment, does this mean Apple would like to take responsibility from RAN5 into RAN4. Can you please clarify?  Third, on the last sentence. This exact sentence is what is being discussed in RAN5 and therefore, the exact reason why the discussion is and should be held in RAN5. We would like to understand why the testing selection should be done in RAN4 instead of RAN5.  Given that this single band testing is this important, have you checked the test time impact of the (proposed solution vs. all bands) vs EN-DC complexity vs the entire positioning set? Or should this discussion be left for RAN5?  Finally, we hope vendors also acknowledge that this “per band” requirement would end up in carrier acceptance plans if we are forced to change this (again, RAN5 discussion), given its importance to carriers. We are not sure that is the best way forward. |

**Sub-topic 1-2: EN-DC bands for testing**

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| **Company** | **Comments** |
| AT&T | Proposal #1: Do not agree. We do not see why testing would be limited to very special cases where multiple IMD products exist and affect all GNSS frequency ranges.  Proposal #2: We agree in principle as it meets the goal of letting RAN5 make the test point decisions needed for the certification bodies. |
| Qualcomm | Proposal #1: This Proposal is not quite clear. This depends on the GNSS(s) and EN-DC configurations supported by the UE. If there is one EN-DC configuration impacting all supported GNSS bands, this single combination should be enough (if supported by the UE).  Proposal #2: We understand this was the agreed Way Forward from last meeting:  "For both LTE/NR bands and EN-DC band combinations, the following details are to be specified as well:  E-UTRA / NR carrier frequencies  Carrier bandwidth  other channel configurations if necessary".  Therefore, we calculated the frequencies in our proposed CRs." |
| Xiaomi | Proposal #1: Share same view as Qualcomm  Proposal #2: The intention for this proposal is to reduce workload in RAN4 and avoid introducing a big table into the spec. Just showing exemplary test frequencies and RB setting for each frequency Group Combinations as listed in Qualcomm’s CR is also a good way. |
| Spirent | To confirm in the agreed WF in the last meeting we did agree that frequencies/bandwidths/other possible configurations would be specified by RAN 4. |
| Apple | Proposal #1:  As the proponent of Proposal 1, let us share our original thinking in the following. In the last meeting, there was agreement:   * + *To further reduce testing, all EN-DC configurations are divided into groups with similar IMD level and risks. For each group, only one of the EN-DC configurations supported by the UE in the group shall be tested. Details can be found at Annex B of reference [1].*   Since there may be multiple EN-DC band combinations falling into the same group, as only one is to be tested, it is proposed to prioritize those combinations that generate both 2nd and 3rd IMDs and deprioritize those that only affect some (not all four) GNSS receiver bands for testing.  Proposal #2:  We have similar view as Xiaomi, and the approach of providing some examples only, as shown in QC’s CR looks good. |
|  |  |

### CRs/TPs comments collection

* The two CRs below implement the following:
  + LTE and NR bands for testing: Option 1 from the WF.
  + EN-DC bands for testing: agreements from the WF without the new proposals above.
* Recommended WF:
  + Discuss if CRs can be endorsed

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2114210**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114210.zip)  (CR to 36.171)  (Qualcomm)  (LTE standalone) | AT&T: Cannot endorse based on feedback above. In addition, any use of NOTE outside of table notes is not considered as a normative requirement according to 3GPP drafting rules. |
| DISH: We cannot agree to this CR. |
| Qualcomm (proponent): We think this covers the agreements from last meeting with Option 1 with single carrier. |
| Spirent: we have some editorial and clarification concerns with this CR but will wait to see what the outcome will be before listing them here.  Apple: we support using the CR, which resulted from the agreements at the last meeting, as a baseline for further discussion. |
| [**R4-2114208**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114208.zip)  (CR to 38.171)  (Qualcomm)  (NR standalone and EN-DC) | AT&T: Cannot endorse based on feedback above. In addition, any use of NOTE outside of table notes is not considered as a normative requirement according to 3GPP drafting rules. |
| DISH: We cannot agree to this CR. |
| Qualcomm (proponent): We think this covers the agreements from last meeting with Option 1 with single carrier. |
| Spirent: we have some editorial and clarification concerns with this CR but will wait to see what the outcome will be before listing them here.  Apple: we support using the CR, which resulted from the agreements at the last meeting, as a baseline for further discussion. |

Above added for clarity

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic 1-1** | **LTE and NR bands for testing**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
|  |  |

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| --- | --- |
|  | **Status summary** |
| **Sub-topic 1-2** | **EN-DC bands for testing**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
|  |  |

### CRs/TPs

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

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

# Topic #2: Others (AI 5.1.10.2)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112478**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112478.zip) | MediaTek Inc., Rohde & Schwarz | On the number of satellites for 3-GNSS scenarios (discussion) |
| [**R4-2112479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip) | MediaTek Inc., Rohde & Schwarz | CR on satellite allocation (draftCR 36.171) (plus CAT A draftCR) |
| [**R4-2112481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip) | MediaTek Inc., Rohde & Schwarz | CR on satellite allocation (draftCR 38.171) (plus CAT A draftCR) |
| [**R4-2113444**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip) | CATT | Draft CR on 36.171 requirements for support of A-GNSS (draftCR 36.171) |
| [**R4-2113443**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip) | CATT | Draft CR on 38.171 requirements for support of A-GNSS (draftCR 38.171) |

## Open issues summary

### Sub-topic 2-1: On the number of satellites for 3-GNSS scenarios

**Observation 1:** the way the GNSS scenarios are defined, the complexity of the test case increases with the number of constellations used.

**Observation 2:** this complexity increase is not consistent with the real field behavior: UEs supporting multiple constellations will generally see many more satellites.

**Proposal 1:** Increase the number of satellites to maintain always an overdetermined system with at least one equation more than unknowns, as shown (for example) in Table 1.

Table 1: Power level and satellite allocation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Satellite allocation for each constellation | | |
| GNSS-1(1) | GNSS-2 | GNSS-3 |
| Single constellation | High signal level | 1 | - | - |
| Low signal level | 5 | - | - |
| Dual constellation | High signal level | 1 | - | - |
| Low signal level | 2 | 3 | - |
| Triple constellation | High signal level | 1 | - | - |
| Low signal level | 2 | 2 | 2 |
| Note 1:GNSS-1, i.e. the system having the satellite with high signal level, shall be selected by the device manufacturer. | | | | |

* Recommended WF:
  + Discuss Observations and Proposal 1
  + Discuss if draft CRs are able to be endorsed.

### Sub-topic 2-2: References updated (CATT)

* Recommended WF:
  + Discuss if draft CRs are able to be endorsed.

## Companies views’ collection for 1st round

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **TP/draftCR number** | **Comments collection** |
| [**R4-2112478**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112478.zip)  (discussion)  (MediaTek Inc., Rohde & Schwarz) | Qualcomm: This requires more analysis. The requirement says: "In this test case 6 satellites are generated for the terminal". It seems the intention was that a UE is required to use SVs from all 2 or 3 constellations in order to pass the test. If we add one more SV to the 3-constellation scenario, then it seems using 2-constellations only may also result in a successful test outcome(?).  In addition, there is the GNSS-GNSS Time Offset assistance data available, and therefore, the number of unknowns would be the same in all 3 cases (single, dual, triple constellation), since a UE would not necessarily need to solve for this time offset. However, assistance data are usually optional and the GNSS-GNSS time offset assistance data may not be provided in real deployments.  In general Observation 2 seem correct - UEs supporting multiple constellations will generally see many more satellites, so the scenario(s) per se look unrealistic. |
| Spirent: I can confirm that the original intention, many years ago, was that the UE would be forced to use SVs from all 3 constellations and that is why the scenario(s) are “unrealistic”. However, if adding one more SV does not invalidate the purpose of the test, then we do not object. |
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| [**R4-2112479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip)  [**R4-2112481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip)  (draftCRs)  (MediaTek Inc., Rohde & Schwarz) | Qualcomm: see above. |
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| [**R4-2113444**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip)  [**R4-2113443**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip)  (draft CRs)  (CATT) | Qualcomm: Not needed. The guideline from the 3GPP specification manager was clear: Existing LPP references do not need to be updated, since 36.355 will exist also in future Releases. |
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## Summary for 1st round

### Open issues

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [**R4-2112479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip)  [**R4-2112481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip)  (MediaTek Inc., Rohde & Schwarz) | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| [**R4-2113444**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip)  [**R4-2113443**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip)  (CATT) |  |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| [**R4-2112138**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112138.zip) | Remaining issues on testing of A-GNSS Sensitivity requirements in NR and LTE | Apple |  |  |
| [**R4-2113303**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113303.zip) | Discussion on Frequency Bands for testing of A-GNSS Sensitivity requirements in NR and LTE | Xiaomi |  |  |
| [**R4-2114210**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114210.zip) | Frequency bands for testing of A-GNSS sensitivity requirements | Qualcomm Incorporated |  |  |
| [**R4-2114208**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114208.zip) | Frequency bands for testing of A-GNSS sensitivity requirements | Qualcomm Incorporated |  |  |
| [**R4-2112478**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112478.zip) | On the number of satellites for 3-GNSS scenarios | MediaTek Inc., Rohde & Schwarz |  |  |
| [**R4-2112479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip) | CR on satellite allocation | MediaTek Inc., Rohde & Schwarz |  |  |
| [**R4-2112481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip) | CR on satellite allocation | MediaTek Inc., Rohde & Schwarz |  |  |
| [**R4-2113444**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip) | Draft CR on 36.171 requirements for support of A-GNSS | CATT |  |  |
| [**R4-2113443**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip) | Draft CR on 38.171 requirements for support of A-GNSS | CATT |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)