**3GPP TSG-RAN WG2 Meeting #118e R2-220xxxx**

**eMeeting May 9th – May 20th, 2022**

**Agenda Item: 7.2.2**

**Source: OPPO**

**Title: Report of [AT118-e][048][IoT-NTN] New Issues (OPPO) – 2st round**

**Document for: Discussion and Decision**

# Introduction

This document is to collect companies’ views for the following offline discussion focusing on UP issues.

* [AT118-e][048][IOTNTN] New Issues (OPPO)

Scope: Treat R2-2204740, R2-2205725, R2-2204741.

Ph1 determine agreeable part, Ph2 endorse TP

Intended outcome: Report, Endorsed TP (if applicable)

Deadline: Schedule 1 (CB online W2 if needed)

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# Round-1 Discussion

## 3.1 Msg3 retransmission

In RAN2#117e, blind Msg3 retransmission has been agreed to be supported for NR NTN, which enables NW to schedule Msg3 retransmission during the UE-gNB RTT in case NW wants to improve the coverage through blind retransmission. See below chairman notes.

Agreements via email – from offline 103 – third round:

1. Blind Msg3 retransmission is supported in Rel-17 NTN. FFS whether this is enabled by a NOTE (P4), or explicit configuration (P5a and P5b).
2. The following NOTE is captured: “UE should attempt to re-aquire SIBxx prior to validity timer expiry by UE implementation.” Details of NOTE (potentially including additional clarification if needed) may be finalized in Stage 3. This is captured in RRC specification (e.g. Section 5.2.2.x)

It is proposed in both [1] and [2] that IoT NTN should align with NR NTN and support blind Msg3 retransmission.

**Question 1: Do companies agree that** **blind Msg3 retransmission should be supported for IoT NTN, similar to NR NTN?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Huawei. HiSilicon | Disagree | We do not see the need for any change for blind retransmission in IOT NTN. Coverage enhancements are a basic function in IOT NTN and the timers set accordingly. |
| MediaTek | Disagree | Support views of Huawei. This is not needed in IoT-NTN. |
| Qualcomm | Disagree |  |
| Lenovo | Disagree | Not needed in IoT NTN |
| Transsion Holdings | Disagree | The MSG3 repetition is a a kind of retransmission in IoT, so blind Msg3 retransmission no needed in IoT NTN. |
| Nokia | Agree | Blind Msg3 retransmission is a legacy function which is already supported in current specification. For IoT over NTN, due to the maximum UE-eNB RTT is 540ms in GEO, the NW may blindly schedule Msg3 retransmissions before it receives/decodes the scheduled PUSCH (Msg3).  For example, for eMTC CE mode A with small number of PDCCH/PUSCH repetitions, NW can only receive and decode the PUSCH after the UE-eNB RTT (540ms). Before the eNB decoding the scheduled PUSCH transmission, it is NW’s scheduling flexibility to schedule a new Msg3 retransmission blindly for coverage enhancement (e.g., during the period the *mac-ContentionResolutionTimer* is still running).  If blind Msg3 retransmission is not supported for IoT NTN, does it mean we need to restrict the NW implementation in MAC specification for above scenario ? Maybe we can reword the proposal as below:  **Blind Msg3 retransmission should be supported for IoT NTN as legacy.** |
| OPPO | Agree | Agree with Nokia. |
| TTP | Agree | Blind Msg3 transmission should be supported |
| Ericsson | Agree | Agree with Nokia. This is useful for coverage and has minor impact to copy the NR NTN solution. |
| InterDigital | Neutral | It doesn’t seem critical since we already have repetitions. However, no strong objection as it could provide more flexibility to the NW without much impact. |
| Xiaomi | Agree | Agree with Nokia that Blind Msg3 transmission is legacy function, no need to disable it in IOT NTN. |
| ZTE | Disagree | We have same view as Huawei. For IoT NTN, as they already have extended value range for *mac-ContentionResolutionTimer,* it’s easy to resolve the issue that *mac-ContentionResolutionTimer* may expire before it is restarted by applying a suitable *mac-ContentionResolutionTimer* (at least some longer than UE-gNB RTT). We also agree with Huawei that no need of any change for blind retransmission in IOT NTN. The only requirement is that NW should apply a suitable *mac-ContentionResolutionTimer* by its implementation for different IoT NTN cases.  For blind msg3 retransmission scheduling, we don’t think it’s legacy function in IoT. We have the following understandings:   1. In legacy IoT, especially for NB-IoT, UE cannot receive another msg3 retransmission grant before it finishes the current PUSCH transmission for Msg3. 2. Yes, after the last subframe of a PUSCH transmission for Msg3, UE can receive another DL transmission. It seems possible that, if at this time NW sends an “early” scheduling for msg3 retransmission, UE can handle it. Here “early” means NW send the msg3 retransmission grant before it successfully decodes the previous UL transmission. As the RTT is very small in legacy IoT, here the time that can be in advance or can be saved may be just the processing time required by NW. We see it’s almost useless to let NW blindly/earlier schedling another msg3 retransmission grant just for saving such small time duration. If further considering that such blind Msg3 retransmission scheduling may be “wrong” as NW is possible to successfully decode the previous Msg3 soon, we see no usage but possible harm for such blind Msg3 retransmission scheduling. 3. As repetition is supported in IoT, we think the effect of NW continuously scheduling Msg3 retransmission twice with small repetitions is same as that of NW scheduling Msg3 retransmission once with larger repetitions. Or the latter may be better as one DL scheduling can be saved.   We can understand blind msg3 retransmission scheduling may bring a bit more benefit in the NTN case with large RTT, e.g., the in advance time for next retransmission scheduling can be larger. But on one hand, such benefit is not so critical for IoT NTN. Moreover, considering the potential disadvantages, e.g., more PDCCH monitoring and more power consumption in UE side, additional scheduling complexity in NW side and possible “wrong” blind Msg3 retransmission schedling as mentioned in above point 2) (we feel the more time NW blindly schedules in advance, the greater the probability of “wrong” blind Msg3 retransmission schedling), the benefits of blind msg3 retransmission in IoT NTN are still doubtful. |
| Nordic | disagree |  |

**[Rapporteur summary]:**

13 companies provided comments. 5 companies think IoT NTN should follow NR NTN to support blind Msg3 retransmission. 7 companies disagree and think that coverage enhancements are a basic function in IoT NTN. 1 company is neutral. Based on slight majority, following is proposed.

**Proposal 1: (7 vs 5) Blind Msg3 retransmission is not supported for IoT NTN.**

Regarding how to implement in the spec on blind Msg3 retransmission, following options are proposed in [1] and [2].

* Option 1: If *mac-ContentionResolutionTimer* expires during the UE-Enb RTT after Msg3 retransmission, (to wait for new CR timer restart) the UE does not consider the Contention Resolution unsuccessful.
* Option 2: If *mac-ContentionResolutionTimer* expires and no PDCCH addressed to TC-RNTI indicating uplink grant for a MSG3 retransmission is received after the start of the *mac-ContentionResolutionTimer*, the UE considers the Contention Resolution not successful

Note that the same issue is being discussed in NR NTN, i.e. phase 2 of [AT118-e][104]. Rapporteur assumes that IoT NTN can follow NR NTN’s conclusion.

**Question 2: Do companies agree that IoT NTN follows NR NTN’s conclusion on how to implement blind Msg3 retransmission in the MAC spec (i.e. modifications to *mac-ContentionResolutionTimer* operation)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Huawei. HiSilicon | Disagree | see answer to Q1 |
| MediaTek | Disagree | See our responses to Question 1. |
| Qualcomm | Disagree but | The issue is same as in NR. But it does not have to be blind retransmission. Ok to stop the running timer by PDCCH addressed to TC-RNTI indicating uplink grant for a MSG3 retransmission.  This can be in similar to what we already have below  - if *mac-ContentionResolutionTimer* expires:  - for BL Ues or Ues in CE or NB-IoT Ues:  - if notification of a reception of a PDCCH transmission has been received from lower layers before *mac-ContentionResolutionTimer* expired; and |
| Lenovo | Disagree | Not needed in IoT NTN |
| Transsion Holdings | Disagree | Not needed in IoT NTN. |
| Nokia | Agree | As discussed in R2-2205725, for IoT NTN, we think below issue is same as in NR (no matter blind Msg3 retx is supported or not).  Since the start of *mac-ContentionResolutionTimer* is delayed by UE-Enb RTT, if *mac-ContentionResolutionTimer* expire during the UE-Enb RTT after Msg3 (re)transmission, it will lead to issue that the UE considers Contention Resolution as not successful (in red as indicated in below figure), even if Msg4 would arrive later.    Regarding how to address the issue, the topic is being discussed in NR NTN, i.e., phase 2 of [AT118-e][104]. We agree with Rapporteur that IoT NTN can follow NR NTN’s conclusion for simplicity. |
| OPPO | Agree |  |
| TTP | Agree |  |
| Ericsson | Agree |  |
| InterDigital | Agree |  |
| Xiaomi | Agree |  |
| ZTE | Disagree | We tend to think the above mentioned Option 1 and Option 2 are not so related to blind Msg3 transmission. They are just to deal with the rare case that *mac-ContentionResolutionTimer* is still not long enough.  If something is really needed (we still doubt it), we think Option 1 and Option 2 can be supported together. That is, only in the case that Msg3 has been retransmitted when *mac-ContentionResolutionTimer* expires, UE don’t need to consider this Contention Resolution not successful. In other cases, expiry of *mac-ContentionResolutionTimer* still means failed Contention Resolution.  We disagree that UE can [deliberately](https://dict.cn/deliberately) stop *mac-ContentionResolutionTimer* upon receiving PDCCH indicating Msg3 retransmission. |
| Nordic | disagree | See answer to Q1 |

**[Rapporteur summary]:**

13 companies provided comments. 6 companies agree to follow NR NTN on how to support blind Msg3 retransmission. 5 companies disagree as they don’t support blind Msg3 retransmission. 1 company does not think the two options are related to blind retransmission but is ok to follow NR procedure. 1 company think both options can be supported together. Since proposal 1 for sure needs online discussion, rapporteur suggests to make a conditional proposal based on majority comments.

**Proposal 2: If RAN2 agrees that blind Msg3 retransmission is supported for IoT NTN, IoT NTN follows NR NTN’s conclusion on how to implement blind Msg3 retransmission in the MAC spec (i.e. modifications to mac-ContentionResolutionTimer operation).**

In [1], it is proposed to introduce an explicit configuration to support blind Msg3 retransmission in IoT NTN and UE behaviour would be different depending on whether blind Msg3 retransmission is configured or not. Note that this is also being discussed in NR NTN, i.e. phase 1 of [AT118-e][104] and rapporteur assumes that IoT NTN can follow NR NTN’s conclusion.

**Question 3: Do companies agree that IoT NTN follows NR NTN’s conclusion on whether to introduce an explicit configuration to support blind Msg3 retransmission?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Huawei. HiSilicon | Disagree | see answer to Q1 |
| MediaTek | Disagree | See our responses to Question 1. |
| Qualcomm | Disagree |  |
| Lenovo | Disagree | Not needed in IoT NTN |
| Transsion Holdings | Disagree | Not needed in IoT NTN. |
| Nokia | Agree. See comments | It was already agreed in NR NTN that explicit configuration is not needed.  🡺 3. Do not introduce an explicit configuration to support blind Msg3 retransmission in NTN. |
| OPPO | Agree | We can accept not introducing explicit configuration. |
| TTP | Agree | As detailed by Nokia above |
| Ericsson | Agree |  |
| InterDigital | Agree |  |
| Xiaomi | Agree |  |
| ZTE | Disagree | Not needed in IoT NTN. Also see our comments for Q1. |
| Nordic | disagree | See answer to Q1. |

**[Rapporteur summary]:**

13 companies provided comments. 6 companies agree to follow NR NTN and not to introduce explicit configuration. 7 companies disagree as they don’t support blind Msg3 retransmission. Since proposal 1 for sure needs online discussion, rapporteur suggests to make a conditional proposal as below.

**Proposal 3: If RAN2 agrees that blind Msg3 retransmission is supported for IoT NTN, do not introduce an explicit configuration to support blind Msg3 retransmission.**

Meanwhile, if blind Msg3 retransmission is not supported (or not configured if it is agreed to be configurable), it is proposed in [1] that UE should stop mac-ContentionResolutionTimer upon receiving PDCCH indicating Msg3 retransmission. Note that this option has been discussed quite a few meetings in NR NTN and received quite much support before NR NTN agreeing on blind Msg3 retransmission. Rapporteur suggests to discuss this option in the 2nd round discussion.

**Proposal 4: If RAN2 agrees that blind Msg3 retransmission is not supported for IoT NTN, RAN2 further discuss in the 2nd round on whether UE do stop mac-ContentionResolutionTimer upon receiving PDCCH indicating Msg3 retransmission.**

## TA report

*Whether SR can be triggered?*

In RAN2#117e, following agreement has been made for NR NTN.

1. If a TA report is triggered and there are no available UL-SCH resources, the network may optionally configure UE to trigger an SR. A UE capability is introduced for this.

In [1], it is proposed that IoT NTN follows NR NTN’s agreements. Given that NR NTN agreements contain many aspects. Following questions are asked to see to which extend companies would like to align with NR NTN.

**Question 4: Do companies agree that in IoT NTN, UE can trigger SR if a TA report is triggered and there are no available UL-SCH resources?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Huawei. HiSilicon | Disagree | The typical traffic pattern is one UL transmission followed optionally by a DL transmission and then the connection release. Triggering RACH only for updating the TA (which is only for UL) will generate unnecessary transmission and waste of power consumption. |
| MediaTek | Disagree | As discussed before in RAN2 117bis-e and pointed out by us, this is not at all necessary and only has the chance to increase complexity in the UE side. |
| Qualcomm | Agree | The issue of not being able to update the TA in time is more severe in IoT NTN. |
| Lenovo | Disagree, but | For now we see no essential reason of reporting TA in RA, and UE may wait until it enters CONNECTED mode to report TA. If any essential reason of reporting TA in RA is identified, we may consider triggering SR for this case. |
| Transsion Holdings | Agree | TA report can be useful for updating the offset, we think it is necessary. |
| Nokia | Disagree | The TA update in IoT NTN is not as necessary as NR NTN due to the IoT service is not time critical. We think NW implementation can handle the case (e.g., schedule UE with maximum TA of the cell via configuring proper K\_offset). |
| OPPO | Agree | Having timely TA reporting is important so that NW can properly adjust Koffset. |
| TTP | Agree | TA reporting is necessary for the Koffset reporting |
| Ericsson | Disagree | Agree with MediaTek and Nokia. |
| InterDigital | Disagree | It is an optional feature in NR, and there is even less motivation to support in IoT for the reasons already given by Huawei and Mediatek. |
| Xiaomi | Agree |  |
| ZTE | Agree but not so strong view | UE-specific TA report is beneficial but only cell-specific TA is still fine as it will not cause transmission failure but just maybe a bit more delay. |
| Nordic | disagree |  |

**[Rapporteur summary]:**

13 companies provided comments. 6 companies agree to follow NR NTN that TA report can trigger SR. 7 companies don’t think this is needed.

**Proposal 5: (7 vs 6) In IoT NTN, TA report cannot trigger SR.**

**Question 5: Do companies agree that in IoT NTN, whether TA report can trigger SR is up to network’s configuration?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Huawei. HiSilicon | Disagree | see Answer to Q4. In addition having a feature optional both at the NW and at the UE (see Q6) is a clear show that the feature is not essential and should not be considered in R17 |
| MediaTek | Disagree | TA report-based SR-trigger is not needed. Please see our response to Question 4. |
| Qualcomm | Agree | Ok to follow NR agreement. |
| Lenovo | Disagree, but | As in Q4, we can accept NW configuration based on essential needs of reporting Ta in RA. |
| Transsion Holdings | Agree |  |
| Nokia | Disagree |  |
| OPPO | Agree |  |
| TTP | Agree |  |
| Ericsson | Disagree |  |
| InterDigital | Disagree |  |
| Xiaomi | Agree |  |
| ZTE | Disagree | No need of such additional complexity. If it’s agreed to support SR triggered by TA report, we hope it can be as simple as possible. Too much DL control from network is also unnecessary overhead (especially for IoT UE using CP solution). |
| Nordic | disagree |  |

**[Rapporteur summary]:**

13 companies provided comments. 6 companies think it can be up to NW configuration. 6 companies disagree as they don’t support TA report triggering SR. 1 company think configuration is not needed. As proposal 5 for sure needs online discussion, rapporteur suggests the following conditional proposal.

**Proposal 6: If RAN2 agrees that TA report can trigger SR, TA report triggering SR is up to network’s configuration.**

**Question 6: Do companies agree that in IoT NTN, a UE capability is introduced for TA report triggering SR?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Huawei. HiSilicon | Disagree | see Answer to Q4 and Q5. |
| MediaTek | Disagree | The feature itself is not needed. See our responses to Q4 and Q5. |
| Qualcomm | Disagree | A single capability for TA report in connected mode should be sufficient. |
| Lenovo | Disagree | Same as Q4 and Q5. |
| Transsion Holdings | Disagree | Support views of Qualcomm. |
| Nokia | Disagree |  |
| OPPO | Agree | But we can also accept grouping this into the single capability for TA report. |
| TTP | Disagree | Agree with Qualcomm |
| Ericsson | Disagree |  |
| InterDigital | Disagree |  |
| Xiaomi | Disagree |  |
| ZTE | Disagree |  |
| Nordic | disagree |  |

**[Rapporteur summary]:**

12 companies do not agree to introduce UE capability and some of those do not support TA report triggering SR. only 1 company suggests to follow NR NTN but can also accept grouping this into the single capability for TA report. As proposal 5 for sure needs online discussion, rapporteur suggests the following conditional proposal.

**Proposal 7: If RAN2 agrees that TA report can trigger SR, do not introduce a separate UE capability for this.**

*Whether configured uplink grant can be used to transmit TA report?*

In the current TS 36.321, following is specified in 5.10.2 for NB-IoT.

|  |
| --- |
| For NB-IoT UEs, a configured uplink grant shall be used only for BSR or SPS confirmation transmission, and *skipUplinkTxSPS* is implicitly configured. |

In [1], it is stated that TA report is also important for UL transmission, and proposed to allow a configured uplink grant to be used for TA report as well.

**Question 7: Do companies agree that for NB-IoT over NTN,** **a configured uplink grant shall also be used for TA report?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Huawei. HiSilicon | Disagree | see Answer to Q4. In addition this would not be a small change and will impact RAN1 |
| MediaTek | Disagree | Agree with the responses of Huawei. |
| Qualcomm | Agree | It is better to use available resource and update the network with current TA in time. |
| Lenovo | Disagree, but | If any essential reason of reporting TA using dedicated CG is identified, we may consider for this case. |
| Transsion Holdings | Disagree |  |
| Nokia | Disagree |  |
| OPPO | Agree | Why not? TA reporting is important for timing adjustment and UE should try to use configured UL grant to report. |
| TTP | Disagree | Not necessary for just TA rporting |
| Ericsson | Disagree |  |
| InterDigital | Disagree |  |
| Xiaomi | Disagree |  |
| ZTE | Agree, but | Considering we have agreed that the priority of TA reporting MAC CE is higher than BSR, it seems reasonable to also allow that a configured uplink grant (we assume it’s SPS) can be used for TA reporting, with additional consideration that this would cause less overhead than TA report over SR.  But we can agree with Huawei that it may need to check whether there will be RAN1 impact (now we assume it may have no). |
| Nordic | disagree |  |

**[Rapporteur summary]:**

3 companies think configured UL grant can transmit TA report. The rest 10 companies do not agree.

**Proposal 8: (10 vs 3) For NB-IoT, configured uplink grant cannot be used for TA report.**

# *4. Round-1 summary*

*Based on companies input, following proposals are given.*

**Proposal 1: (7 vs 5) Blind Msg3 retransmission is not supported for IoT NTN.**

**Proposal 2: If RAN2 agrees that blind Msg3 retransmission is supported for IoT NTN, IoT NTN follows NR NTN’s conclusion on how to implement blind Msg3 retransmission in the MAC spec (i.e. modifications to mac-ContentionResolutionTimer operation).**

**Proposal 3: If RAN2 agrees that blind Msg3 retransmission is supported for IoT NTN, do not introduce an explicit configuration to support blind Msg3 retransmission.**

**Proposal 4: If RAN2 agrees that blind Msg3 retransmission is not supported for IoT NTN, RAN2 further discuss in the 2nd round on whether UE should stop mac-ContentionResolutionTimer upon receiving PDCCH indicating Msg3 retransmission.**

**Proposal 5: (7 vs 6) In IoT NTN, TA report cannot trigger SR.**

**Proposal 6: If RAN2 agrees that TA report can trigger SR, TA report triggering SR is up to network’s configuration.**

**Proposal 7: If RAN2 agrees that TA report can trigger SR, do not introduce a separate UE capability for this.**

**Proposal 8: (10 vs 3) For NB-IoT, configured uplink grant cannot be used for TA report.**

# Round-2 Discussion

One remaining issue after 1st round discussion is whether UE should stop mac-ContentionResolutionTimer upon receiving PDCCH indicating Msg3 retransmission if blind Msg3 retransmission is not supported (or not configured if it is agreed to be configurable). In [1], it is stated that if UE does not stop mac-ContentionResolutionTimer upon receiving PDCCH indicating Msg3 retransmission, it will cause the timer to expire and RACH attempt to fail unexpectedly while UE is still waiting for Msg4. It also wastes UE’s power for monitoring as blind retransmission is not expected during the UE-eNB RTT time before mac-ContentionResolutionTimer is started. Note that this solution has been discussed a few meetings in NR NTN and received quite much support before NR NTN starts to agree on blind Msg3 retransmission.

**Question 1: If RAN2 agrees that blind Msg3 retransmission is not supported for IoT NTN, do you agree that UE should stop mac-ContentionResolutionTimer upon receiving PDCCH indicating Msg3 retransmission?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
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As 1st round summary is expected to be treated online this Wednesday, rapporteur thinks that we should be ready for the TP no matter which decision is made on supporting blind Msg3 retransmission. If it is agreed to be supported, then IoT NTN can follow NR NTN’s MAC spec which is being discussed. If it is agreed not to be supported, rapporteur provides the following TP for 36.321.

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| --- |
| 5.1.5 Contention Resolution Contention Resolution is based on either C-RNTI on PDCCH of the SpCell or UE Contention Resolution Identity on DL-SCH.  Once Msg3 is transmitted, the MAC entity shall:  - if the UE is an NB-IoT UE, a BL UE or a UE in enhanced coverage:  - if Msg3 is transmitted on a non-terrestrial network:  - if, for EDT, *edt-SmallTBS-Enabled* is set to *TRUE* for the corresponding PRACH resource:  - start *mac-ContentionResolutionTimer* and restart *mac-ContentionResolutionTimer* at each HARQ retransmission of the bundle in the subframe corresponding to the last subframe of a PUSCH transmission corresponding to the largest TBS indicated by the UL grant plus the UE estimate of UE-eNB RTT subframes.  - else:  - start *mac-ContentionResolutionTimer* and restart *mac-ContentionResolutionTimer* at each HARQ retransmission of the bundle in the subframe containing the last repetition of the corresponding PUSCH transmission plus the UE estimate of UE-eNB RTT subframes.  - if notification of a reception of a PDCCH transmission indicating Msg3 retransmission is received from lower layers:  - stop mac-ContentionResolutionTimer.  …<unchanged part> |

**Question 2: if you agree to Q1, do you agree to the above TP? If not, please provide wording suggestion.**

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| **Company** | **Agree/Disagree** | **Comments** |
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# *6. Round-2 summary*

*To be added.*

# 7. References

1. R2-2204740 Discussion on mac-ContentionResolutionTimer in IoT NTN OPPO
2. R2-2205725 Alignment with NR NTN for Msg3 blind retransmission Nokia, Nokia Shanghai Bell
3. R2-2204741 Discussion on TA report in IoT NTN OPPO