**3GPP TSG-RAN WG1 meeting #118R1-24xxxxx**

Maastricht, NL, August 19th–23rd, 2024

**Title : Summary on Msg3 retransmission timing in NTN**

**Source : Moderator (ZTE)**

**Agenda item : 7**

**Document for : Discussion and Decision**

# Introduction

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| **Follow up discussion on Msg3 reTX timing from RAN1#117**  R1-2405837 Correction on the timing of Msg3 retransmission in NTN Huawei, HiSilicon  R1-2406127 Correction on timing of Msg3 retransmission in NTN ZTE Corporation, Sanechips  To be moderated by TBD (ZTE) |

This document contains the summary for Msg3 retransmission timing based on contributions [1][2] in RAN1#118. During RAN1#117, the issue of Msg3 retransmission timing was discussed but no CR agreed due to limited time. In this meeting, the discussion is discussed and details are summarized below

# Discussion (Round 1)

## **TPs for TS 38.214**

As mentioned by [Huawei, HiSilicon, ZTE], the cell specific Koffset was agreed to be always used for the Msg3 retransmission scheduled by DCI in RAN1#105-e meeting. However, in current spec, the timing determination of Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI is not reflected. To capture the timing of Msg3 retransmission, following TPs for TS 38.214 are proposed.

### ***TP#1***

Proposed by Huawei, HiSilicon[1]

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| ***Reason for change:*** | Cell specific Koffset was agreed in RAN1#105-e to be always used for Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI. However, current Rel-17 TS 38.214 only specifies the determination of scheduling offset for PUSCH scheduled by a DCI other than DCI format 0\_0 with CRC scrambled by TC-RNTI.  RAN1#117 discussed this issue and the group preferred to update TS 38.214 to specify the determination of scheduling offset for retransmission of Msg3 scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI. |
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| ***Summary of change:*** | Update the description of Koffset in section 6.1.2.1 to define Koffset as cell specific Koffset for determination of the slot *Ks* where the UE shall transmit the PUSCH of Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI. For other cases, Koffset is defined as specified in TS 38.213. |
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| ***Consequences if not approved:*** | Scheduling offset for Msg3 retransmission is not defined for NR NTN. |

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| **< Start of change request >**  6.1.2 Resource allocation  6.1.2.1 Resource allocation in time domain  When the UE is scheduled to transmit a transport block and no CSI report by a DCI or by a RAR UL grant or fallbackRAR UL grant, or the UE is scheduled to transmit a transport block and a CSI report(s) on PUSCH by a DCI, the '*Time domain resource assignment'* field value *m* of the DCI or the *PUSCH time resource allocation* field value *m* of the RAR UL grant or of the fallbackRAR UL grant provides a row index *m* + 1to an allocated table. The determination of the used resource allocation table is defined in Clause 6.1.2.1.1. The indexed row defines the slot offset *K2*, the start and length indicator *SLIV*, or directly the start symbol *S* and the allocation length *L*, the PUSCH mapping type, the number of slots used for TBS determination (if *numberOfSlotsTBoMS* is present in the resource allocation table), and the number of repetitions (if *numberOfRepetitions* is present in the resource allocation table) to be applied in the PUSCH transmission.  When the UE is scheduled to transmit a PUSCH with no transport block and with a CSI report(s) by a '*CSI request'* field on a DCI, the '*Time domain resource assignment'* field value *m* of the DCI provides a row index *m* + 1to the allocated table as defined in Clause 6.1.2.1.1. The indexed row defines the start and length indicator SLIV, or directly the start symbol *S* and the allocation length *L*, and the PUSCH mapping type to be applied in the PUSCH transmission and the *K2* value is determined as , where  are the corresponding list entries of the higher layer parameter  - *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17*, if PUSCH is scheduled by DCI format 0\_2 and *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17* is configured;  - *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17*, if PUSCH is scheduled by DCI format 0\_1 and *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17* is configured;  - *reportSlotOffsetList* or *reportSlotOffsetList-r17*, otherwise;  in *CSI-ReportConfig* for the  triggered CSI Reporting Settings and  is the *(m+1)*th entry of  including the omitted CSI Reporting Settings triggered for non-active DL BWPs, where the UE does not expect that *(m+1)* is larger than 16.  - The slot *Ks* where the UE shall transmit the PUSCH is determined by *K2* as *Ks* =, if UE is configured with *ca-SlotOffset* for at least one of the scheduled and scheduling cell, , otherwise, where is the subcarrier spacing configuration for with a value of 0 for frequency range 1, *n* is the slot with the scheduling DCI, K*2* is based on the numerology of PUSCH,  and  are the subcarrier spacing configurations for PUSCH and PDCCH, respectively, and where is a parameter provided by *cellSpecificKoffset* if the scheduling DCI is DCI format 0\_0 with CRC scrambled by TC-RNTI, otherwise, is a parameter configured by higher layer as specified in clause 4.2 of [6 TS 38.213].  **<End of change request>** |

### ***TP#2***

Proposed by ZTE[2]

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| ***Reason for change:*** | In RAN1#105-e meeting, the cell specific Koffset was agreed to be always used for the Msg3 retransmission scheduled by DCI.   |  | | --- | | Agreement:  The K\_offset value signaled in system information is always used for   * The transmission timing of RAR / fallbackRAR grant scheduled PUSCH * The transmission timing of Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI * The transmission timing of HARQ-ACK on PUCCH to contention resolution PDSCH scheduled by DCI format 1\_0 with CRC scrambled by TC-RNTI   + FFS: The transmission timing of HARQ-ACK on PUCCH to contention resolution PDSCH scheduled by DCI format 1\_0 with CRC scrambled by C-RNTI * The transmission timing of HARQ-ACK on PUCCH to MsgB scheduled by DCI format 1\_0 with CRC scrambled by MsgB-RNTI   + FFS: The transmission timing of HARQ-ACK on PUCCH to MsgB scheduled by DCI format 1\_0 with CRC scrambled by C-RNTI   FFS: how to treat additional transmission timings related to fallback DCI formats  FFS: how to update this formulation with beam-specific K\_offset if beam-specific K\_offset is agreed to be supported  Note: The mapping ordering and steps may be revisited if multiple CG PUSCH occasions in one CG period is supported |   However, in current spec, the above timing of Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI is not reflected. |
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| ***Summary of change:*** | For the timing specification of PUSCH scheduled by DCI, add the case of PUSCH scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI and specify that Kcell,offset is used in this case. |
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| ***Consequences if not approved:*** | Timing of msg3 retransmission is not defined in NTN case. |

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| 6.1.2.1 Resource allocation in time domain  **< Unchanged text omitted >**  When the UE is scheduled to transmit a transport block and no CSI report by a DCI or by a RAR UL grant or fallbackRAR UL grant, or the UE is scheduled to transmit a transport block and a CSI report(s) on PUSCH by a DCI, the '*Time domain resource assignment'* field value *m* of the DCI or the *PUSCH time resource allocation* field value *m* of the RAR UL grant or of the fallbackRAR UL grant provides a row index *m* + 1to an allocated table. The determination of the used resource allocation table is defined in Clause 6.1.2.1.1. The indexed row defines the slot offset *K2*, the start and length indicator *SLIV*, or directly the start symbol *S* and the allocation length *L*, the PUSCH mapping type, the number of slots used for TBS determination (if *numberOfSlotsTBoMS* is present in the resource allocation table), and the number of repetitions (if *numberOfRepetitions* is present in the resource allocation table) to be applied in the PUSCH transmission.  When the UE is scheduled to transmit a PUSCH with no transport block and with a CSI report(s) by a '*CSI request'* field on a DCI, the '*Time domain resource assignment'* field value *m* of the DCI provides a row index *m* + 1to the allocated table as defined in Clause 6.1.2.1.1. The indexed row defines the start and length indicator SLIV, or directly the start symbol *S* and the allocation length *L*, and the PUSCH mapping type to be applied in the PUSCH transmission and the *K2* value is determined as , where  are the corresponding list entries of the higher layer parameter  - *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17*, if PUSCH is scheduled by DCI format 0\_2 and *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17* is configured;  - *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17*, if PUSCH is scheduled by DCI format 0\_1 and *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17* is configured;  - *reportSlotOffsetList* or *reportSlotOffsetList-r17*, otherwise;  in *CSI-ReportConfig* for the  triggered CSI Reporting Settings and  is the *(m+1)*th entry of  including the omitted CSI Reporting Settings triggered for non-active DL BWPs, where the UE does not expect that *(m+1)* is larger than 16.  - The slot *Ks* where the UE shall transmit the PUSCH is determined by *K2* as *Ks* =, if UE is configured with *ca-SlotOffset* for at least one of the scheduled and scheduling cell, , if the scheduling DCI is DCI format 0\_0 with CRC scrambled by TC-RNTI, , otherwise, where and are parameters configured by higher layer as specified in clause 4.2 of [6 TS 38.213], and where and are the subcarrier spacing configurations for and , respectively, with a value of 0 for frequency range 1, *n* is the slot with the scheduling DCI, K*2* is based on the numerology of PUSCH,  and  are the subcarrier spacing configurations for PUSCH and PDCCH, respectively.  - and are the and the, respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell receiving the PDCCH, and are the and the,respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell transmitting the PUSCH, as defined in clause 4.5 of [4, TS 38.211], and  - for PUSCH scheduled by DCI format 0\_1, if *pusch-RepTypeIndicatorDCI-0-1* is set to 'pusch-RepTypeB', the UE applies PUSCH repetition Type B procedure when determining the time domain resource allocation. For PUSCH scheduled by DCI format 0\_2, if *pusch-RepTypeIndicatorDCI-0-2* is set to 'pusch-RepTypeB', the UE applies PUSCH repetition Type B procedure when determining the time domain resource allocation. Otherwise, the UE applies PUSCH repetition Type A procedure when determining the time domain resource allocation for PUSCH scheduled by PDCCH, by RAR UL grant, or by fallbackRAR UL grant.  - for PUSCH scheduled by DCI format 0\_1 or DCI format 0\_2, if *numberOfSlotsTBoMS* is present and larger than 1, the UE applies TB processing over multiple slots procedure when determining the time domain resource allocation.  - For PUSCH repetition Type A and TB processing over multiple slots, the starting symbol *S* relative to the start of the slot, and the number of consecutive symbols *L* counting from the symbol *S* allocated for the PUSCH are determined from the start and length indicator *SLIV* of the indexed row:  if  then    else    where, and  - For PUSCH repetition Type B, the starting symbol *S* relative to the start of the slot, and the number of consecutive symbols *L* counting from the symbol *S* allocated for the PUSCH are provided by *startSymbol* and *length* of the indexed row of the resource allocation table, respectively.  - For PUSCH repetition Type A and TB processing over multiple slots, the PUSCH mapping type is set to Type A or Type B as defined in Clause 6.4.1.1.3 of [4, TS 38.211] as given by the indexed row.  - For PUSCH repetition Type B, the PUSCH mapping type is set to Type B.  **< Unchanged text omitted >** |

From moderator’s perspective, both of the TPs above aim to capture the timing of Msg3 retransmission and can work. The main difference is whether to refer to the defined in TS 38.213 or directly modify the definition of when specifying cell specific Koffset in TS 38.214. In Rel-17 discussion, the group preferred to only refer to TS 38.213 rather than repeat the Koffset configuration in TS 38.214 as reflected in following agreed TP in Rel-17 [3][4].

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| **Agreed TP #6E in RAN1#108-e:**  ---- Start of TP for TS 38.214 ---  6.1.2.1 Resource allocation in time domain  in *CSI-ReportConfig* for the  triggered CSI Reporting Settings and  is the *(m+1)*th entry of .  - The slot *Ks* where the UE shall transmit the PUSCH is determined by *K2* as *Ks* =, if UE is configured with *ca-SlotOffset* for at least one of the scheduled and scheduling cell, , otherwise, where is a parameter configured by higher layer as specified in [TS38.213 clause 4.2], and where is the subcarrier spacing configuration for with a value of 0 for frequency range 1, *n* is the slot with the scheduling DCI, K*2* is based on the numerology of PUSCH,  and  are the subcarrier spacing configurations for PUSCH and PDCCH, respectively, and the scheduling DCI is other than DCI format 0\_0 with CRC scrambled by TC-RNTI.  ---- End of TP for TS 38.214 --- |

Hence, TP#2, which refers to the cell specific Koffset defined in TS 38.213, seems to be more aligned with the spirit of specification in Rel-17.

## **Company view**

Regarding the draft TPs above, the following questions are provided:

### ***Question 1***

Do you agree that the timing of Msg3 retransmission is missing in current spec?

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| Company | Comment |
| vivo | Agree |
| Ericsson | Agree |
| Lenovo | Agree |
| CATT | Agree |
| Nokia | Agree |
| DCM | Agree |
| Huawei, HiSilicon | Agree |
| New H3C | Agree |

### ***Question 2***

Which TP version in section 1.1 is preferred? Or any other wording?

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| Company | Comment |
| vivo | We slight prefer TP1 as it is more straightforward. However, we also recognize that TP2 aligns with the previous guidance and can accept either option. |
| Ericsson | Slight preference for TP#1 since it does not duplicate the formula.  If TP#2 is used as baseline, we think there is no need to define a new parameter . The existing can be used. |
| Lenovo | Since there is clear definition for and in current TS38.213 clause 4.2, we slightly prefer TP2 formulation to have unified definition of to avoid any potential confusion for two specs.  Note we also recognize the issue noted by E///, and should be always the same.  TS38.213 clause 4.2:  , where is provided by *CellSpecific\_Koffset* and is provided by a Differential Koffset MAC CE command [11, TS 38.321] |
| CATT | Regarding this issue, the change should be revised. Because the beginning sentence of this paragraph says  “When the UE is scheduled to transmit a PUSCH with no transport block and with a CSI report(s) by a '*CSI request'* field on a DCI, ”,  However, this msg-3 retransmission is not relevant to CSI request, and it is linked to initial transmission without CSI request. So the change should be placed in the first paragraph in the section of 6.1.2.1.  Please take a look the first sentence of first graph at section of 6.1.2.1:  “When the UE is scheduled to transmit a transport block and no CSI report by a DCI or by a RAR UL grant or fallbackRAR UL grant, or the UE is scheduled to transmit a transport block and a CSI report(s) on PUSCH by a DCI,”  **Hence, we can’t agree these two CRs.** The msg-3 retransmission change needs to be placed in the first paragraph of 6.1.2.1. |
| Nokia | We have a preference for TP1, as it is more straight forward.  One small modification change may be considered for better readability: Consider putting a “.” after “TC-RNTI”, such that it is clear that the “otherwise, K-offset...” is a separate statement. That is.  is the slot with the scheduling DCI, K*2* is based on the numerology of PUSCH,  and  are the subcarrier spacing configurations for PUSCH and PDCCH, respectively, and where is a parameter provided by *cellSpecificKoffset* if the scheduling DCI is DCI format 0\_0 with CRC scrambled by TC-RNTI. Otherwise, is a parameter configured by higher layer as specified in clause 4.2 of [6 TS 38.213]. |
| DCM | TP1 seems better. |
| Huawei, HiSilicon | TP1 is preferred. |
| Samsung | For TP itself, TP1 is preferable since it is more concise. But, it is okay to go with Nokia’s further correction. As for cover sheet, TP2 is preferable since it is referring relevant agreement to fix the issue. |
| New H3C | TP1 is preferred. |

## **Summary of 1st round discussion**

Based on the inputs in 1st round discussion, all the companies agree that the timing of Msg3 retransmission is missing in current specification and need to be corrected.

Regarding concern from [CATT], in moderator’s view, the subbullets after the second paragraph should apply to both the first and second paragraph, i.e., applicable for both CSI request PUSCH and other PUSCH types. Otherwise, there will be no specification on the PUSCH timing for PUSCH types illustrated in first paragraph. Hence, it seems better to directly modify the subbullets as in TP#1 and TP#2 instead of adding additional subbullets for first paragraph.

Regarding the TP, TP1 is slightly preferred by more companies. But there are also some companies showing concerns as following:

* Duplicated definition of parameter in TS38.214 and TS38.213, which may cause confusion
* The meaning of “otherwise” after “TC-RNTI” is not very clear.
* The cover of TP#2 is more preferred than TP#1 since it refers to relevant agreement for the issue.

Based on above comments, updated TP based on TP1 can be considered in 2nd round discussion.

# Discussion (Round 2)

## **Updated TP**

Based on inputs in first round, updated TP based on TP#1 is proposed to resolve concerns proposed by companies. The cover of TP#2 is used to clearly refer to the agreement that need to be captured in spec. Regarding the potential misunderstanding on the “otherwise” after “TC-RNTI”, an update may be beneficial, especially considering another “if … otherwise …” has already been used previously. However, directly revising the comma to a period seems to make the original sentence splitted and not complete. A potential update to improve the readability may be to list the definitions of Koffset in two subbullets, which makes the meaning of “otherwise” crystally clear and easy to read. Regarding the duplicated definition TS38.213 and TS38.214, seems majority companies can live with it. With above considerations, the moderator proposes following updated TP.

### ***TP#3***

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| ***Reason for change:*** | In RAN1#105-e meeting, the cell specific Koffset was agreed to be always used for the Msg3 retransmission scheduled by DCI.   |  | | --- | | Agreement:  The K\_offset value signaled in system information is always used for   * The transmission timing of RAR / fallbackRAR grant scheduled PUSCH * The transmission timing of Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI * The transmission timing of HARQ-ACK on PUCCH to contention resolution PDSCH scheduled by DCI format 1\_0 with CRC scrambled by TC-RNTI   + FFS: The transmission timing of HARQ-ACK on PUCCH to contention resolution PDSCH scheduled by DCI format 1\_0 with CRC scrambled by C-RNTI * The transmission timing of HARQ-ACK on PUCCH to MsgB scheduled by DCI format 1\_0 with CRC scrambled by MsgB-RNTI   + FFS: The transmission timing of HARQ-ACK on PUCCH to MsgB scheduled by DCI format 1\_0 with CRC scrambled by C-RNTI   FFS: how to treat additional transmission timings related to fallback DCI formats  FFS: how to update this formulation with beam-specific K\_offset if beam-specific K\_offset is agreed to be supported  Note: The mapping ordering and steps may be revisited if multiple CG PUSCH occasions in one CG period is supported |   However, in current spec, the above timing of Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI is not reflected. |
|  |  |
| ***Summary of change:*** | For the timing specification of PUSCH scheduled by DCI, add the case of PUSCH scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI and specify that Kcell,offset is used in this case. |
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| ***Consequences if not approved:*** | Timing of msg3 retransmission is not defined in NTN case. |

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| **< Start of change request >**  6.1.2 Resource allocation  6.1.2.1 Resource allocation in time domain  When the UE is scheduled to transmit a transport block and no CSI report by a DCI or by a RAR UL grant or fallbackRAR UL grant, or the UE is scheduled to transmit a transport block and a CSI report(s) on PUSCH by a DCI, the '*Time domain resource assignment'* field value *m* of the DCI or the *PUSCH time resource allocation* field value *m* of the RAR UL grant or of the fallbackRAR UL grant provides a row index *m* + 1to an allocated table. The determination of the used resource allocation table is defined in Clause 6.1.2.1.1. The indexed row defines the slot offset *K2*, the start and length indicator *SLIV*, or directly the start symbol *S* and the allocation length *L*, the PUSCH mapping type, the number of slots used for TBS determination (if *numberOfSlotsTBoMS* is present in the resource allocation table), and the number of repetitions (if *numberOfRepetitions* is present in the resource allocation table) to be applied in the PUSCH transmission.  When the UE is scheduled to transmit a PUSCH with no transport block and with a CSI report(s) by a '*CSI request'* field on a DCI, the '*Time domain resource assignment'* field value *m* of the DCI provides a row index *m* + 1to the allocated table as defined in Clause 6.1.2.1.1. The indexed row defines the start and length indicator SLIV, or directly the start symbol *S* and the allocation length *L*, and the PUSCH mapping type to be applied in the PUSCH transmission and the *K2* value is determined as , where  are the corresponding list entries of the higher layer parameter  - *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17*, if PUSCH is scheduled by DCI format 0\_2 and *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17* is configured;  - *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17*, if PUSCH is scheduled by DCI format 0\_1 and *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17* is configured;  - *reportSlotOffsetList* or *reportSlotOffsetList-r17*, otherwise;  in *CSI-ReportConfig* for the  triggered CSI Reporting Settings and  is the *(m+1)*th entry of  including the omitted CSI Reporting Settings triggered for non-active DL BWPs, where the UE does not expect that *(m+1)* is larger than 16.  - The slot *Ks* where the UE shall transmit the PUSCH is determined by *K2* as *Ks* =, if UE is configured with *ca-SlotOffset* for at least one of the scheduled and scheduling cell, , otherwise, where is the subcarrier spacing configuration for with a value of 0 for frequency range 1, *n* is the slot with the scheduling DCI, K*2* is based on the numerology of PUSCH,  and  are the subcarrier spacing configurations for PUSCH and PDCCH, respectively, and where  - is a parameter provided by *cellSpecificKoffset* if the scheduling DCI is DCI format 0\_0 with CRC scrambled by TC-RNTI;  - otherwise, is a parameter configured by higher layer as specified in clause 4.2 of [6 TS 38.213].  **<End of change request>** |

## **Company view**

According to the 1st round discussion, the TP#3 in section 2.1 is proposed to resolve comments from companies. Further comments on the TP#3 are welcome before Wednesday’s online session:

Any comments on TP#3?

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# Proposals for discussion

To be updated

# Conclusion

# Reference

1. R1-2405837 Correction on the timing of Msg3 retransmission in NTN Huawei, HiSilicon
2. R1-2406127 Correction on timing of Msg3 retransmission in NTN ZTE Corporation, Sanechips
3. R1-2202784 Session notes for 8.4 (Maintenance on Solutions for NR to support non-terrestrial networks (NTN)) RAN1#108-e
4. R1-2202811 Feature lead summary#5 on timing relationship enhancements RAN1#108-e