P3GPP TSG-RAN WG1 Meeting #104-e R1-2102264

e-Meeting, January 25th – February 05th, 2021

Agenda Item: 8.4.2

Source: Moderator (Thales)

Title: Moderator summary for [104-e-Post-R17-NTN-01] Email discussion on LS to RAN4 on NTN UL time and frequency synchronization requirements

Document for: Discussion and Decision

# Introduction

This document captures inputs from participating companies on the following DRAFT LS to RAN4:

[104-e-Post-R17-NTN-01] Email discussion on LS to RAN4 on NTN UL time and frequency synchronization requirements from Feb 22 – Feb 26

The email discussion was handled using ETSI’s new platform for collaborative drafting called New Working Methods (NWM).

The draft LS is based on the following agreement [1]:

**Agreement:**

**RAN1 should send an LS to RAN4 with the following questions:**

**Question 1: RAN1 would like to ask RAN4, to indicate what are the NTN UL time synchronization requirements?**

* **For initial access (i.e. PRACH transmission)**
* **For UL transmissions in RRC Connected State**

**Question 2: RAN1 would like to ask RAN4, to indicate what are the NTN UL frequency synchronization requirements?**

* **For initial access (i.e. PRACH transmission)**
* **For UL transmissions in RRC Connected State**

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# Inputs on the first variant

Related discussion can be found in:

<https://nwm-trial.etsi.org/#/documents/1651>

## Feedback on the introductory text

The introductory text is the following:

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| Overall DescriptionAs part of the WI NR-NTN-solution, under agenda item 8.4.2, RAN1 discussed the NTN ULsynchronization requirements in terms of time alignment and frequency error for:• Initial access (i.e. PRACH transmission)• UL transmissions in RRC CONNECTED State.RAN1 discussion on NTN UL time and frequency synchronization requirements is captured in theFL Summary of the contributions under AI 8.4.2 at TSG-RAN WG1 #104-e **[R1-2102215].**w.r.t UL time synchronization requirements, for the self-acquisition of the TA before PRACH transmission and for TA update in RRC\_CONNECTED state, the general assumption within the TDocs submitted to RAN1#104-e is that the aggregate contribution of all sources of time inaccuracy and multipath propagation delays must not violate the limits imposed by the cyclic prefix.w.r.t UL frequency synchronization requirements, for UE in RRC\_IDLE, RRC\_INACTIVE, and RRC\_CONNECTED states, the main assumption within the TDocs submitted to RAN1#104-e is that accuracy of UE pre-compensation of Doppler shift shall meet the maximum UL frequency error of ± 0.1ppm for UL transmission.RAN1 identified the following questions that need clarification from RAN4: |

**Feedback Form 1: Please provide your feedback on the introductory text**

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| **Item** | **Company** | **Comments** |
| 1 | QualcommCDMA Technolo- gies | It is preferred not to mention RAN1’s assumptions on the accuracy. For in-stance, we may have mentioned 0.1 ppm accuracy in some of the discussion assuming no change in the requirement for NTN. However, this does not mean RAN1 believes that 0.1 ppm is the best requirement for NTN. It should be up to RAN4 to decide. |
| 2 | LG Elec-tronicsInc. | We agree with QC’s view. It is desirable for RAN4 to determine this issue. So,we prefer not to mention RAN1’s assumptions. |
| 3 | NokiaDenmark | For the UL time synchronization, it would be preferable to explicitly state thatit is RAN1’s understanding that the inaccuracies and multipath components should not violate the limits imposed by the CP when the UL signals are re- ceived at the gNB. Hence we would suggest to clarify this part in the paragraph.The second part related to UL frequency synchronization should basically target the same outcome – that is, having the maximum UL frequency error “when received at the gNB”. After all, it is at the gNB we will have the combined signals received and also here we would deal with the impacts of the impairments.On top of the above we think that either the background or the question(s) should reflect that the frequency error in question should be the total accu- mulated frequency error (including Doppler, Doppler pre-compensation, car- rier frequency offset, phase noise, etc). After all, this error is what the gNB will need to consider during demodulation/detection.If deemed necessary by the group it would be OK for us to exclude any specific reference to existing values/requirements. |
| 4 | THALES | Moderator’s view:Based on the views expressed so far, we can simply remove the two paragraphs about RAN1’s understanding/assumptions.Of course we need to wait for other feebacks to decide. Section 1Overall Description might be simplified as follows:As part of the WI NR-NTN-solution, under agenda item 8.4.2, RAN1 discussed the NTN UL synchronization requirements in terms of time alignment and frequency error for:• Initial access (i.e. PRACH transmission)• UL transmissions in RRC CONNECTED State.RAN1 discussion on NTN UL time and frequency synchronization requirements is captured in the FL Summary of the contributions under AI 8.4.2 at TSG-RAN WG1 #104-e [R1-2102215]. |
| 5 | EricssonLM | We support the moderator’s proposal to remove the two paragraphs startingwith “w.r.t”. There is no need to mention RAN1 assumptions on the require- ments, especially since there are no formal agreements in RAN1.Further, as Nokia points out, it is the total accumulated error at the gNB re- ceiver that is of importance. This goes for both time and frequency requirements and should be clarified either in the Introductory text or in the Questions. |
| 6 | ZTE Cor-poration | The updates from moderator is fine but w.r.t the last sentence in the new ver-sion, it can be further updated as ’RAN1 has conduct corresponding discussion on NTN UL time and frequency synchronization requirements. is captured in the FL Summary of the contributions under AI 8.4.2 at TSG-RAN WG1 #104-e [R1-2102215]. ’In addition, w.r.t the Nokia’s commnents, we share similar views and maybe we need firstly clarify that the ’requirements’ listed in the questions refers to the final ’total accumulated error’ since traditionally, the RAN4 only focus on the final RRM performance. |
| 7 | HuaweiTech- nologies France | We are fine to remove the two paragraph as the moderator suggested. In ad-dtion, we suggest to remove ”AI 8.4.2” in the last sentence. The other part of the FL summary are also very informative for the other working groups to understand the whole discussion. |
| 8 | MediaTekInc. | We are fine with Moderator’s proposal. The requirement for UL time alignmentand frequency error should be discussed for the total accummulated error at the gNB. |
| 9 | SamsungElectron- ics Co., Ltd | We are fine with Moderator’s latest proposal. |

## Feedback on the questions to RAN4

The two questions to RAN4 are:

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| **Question 1: What are the NTN UL time synchronization requirements?****-For initial access (i.e. PRACH transmission)****-For UL transmissions in RRC Connected State****Question 2: What are the NTN UL frequency synchronization requirements?****-For initial access (i.e. PRACH transmission)****-For UL transmissions in RRC Connected State** |

**Feedback Form 2: Please provide your feedback on the two questions**

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| **Item** | **Company** | **Comments** |
| 1 | THALES | Adding the two bullets under each question:**Question 1: What are the NTN UL time synchronization require- ments?**• **For initial access (i.e. PRACH transmission)**• **For UL transmissions in RRC Connected State****Question 2: What are the NTN UL frequency synchronization re- quirements?**• **For initial access (i.e. PRACH transmission)**• **For UL transmissions in RRC Connected State** |
| 2 | LG Elec-tronicsInc. | Agree with THALES. |
| 3 | NokiaDenmark | Agree with Thales that the two sets of questions should have separate bullets.Further, to have 100% clarity of the target of the requirements, it might be beneficial to highlight that the questions are related to the requirements for the signals when they are received at the gNB. |
| 4 | THALES | Moderator’s view:In principle, the reference point for time and frequency to be considered to specify such requirement is as defined in section 4.3 of TS 38.104.Based on Nokia’s feedback, I will add the follwoing note under the questions: Note: The questions above are related to the requirements for the signals when they are received at the gNB. |
| 5 | ZTE Cor-poration | Agree with moderator’s updates. |
| 6 | NokiaDenmark | In principle OK with the note, but should we have a clarification that fromRAN1 side we would like to have the requirements such that they are including the ”total accumulated error” in both time and frequency domain? |
| 7 | HuaweiTech- nologies France | Fine with the latest update from the moderator. |
| 8 | EutelsatS.A. | RAN1 and 4 must note the RAN3 architecture in their considerations. As perR3-211344 w.r.t the logical architecture of an NTN it was noted that RAN4 aspects are out of scope. From my understanding, RAN4 may need to discuss further the reference point to be used to define time and frequency compensation requirements. My working assumption would be it is the satellite antenna port. |
| 9 | MediaTekInc. | Support Moderator’s proposal. The requirement for UL time alignment and fre-quency error should be discussed for the total accummulated error at the gNB. We expect RAN4/RAN5 should define a test for the UL time and frequency requirements at the gNB once the requirements are specified. |
| 10 | SamsungElectron- ics Co., Ltd | We are fine with Moderator’s latest proposal. |

## Feedback on the actions to RAN4

The Actions to RAN4 are the followings:

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| **To TSG RAN WG4****ACTION 1:** RAN1 respectfully asks RAN4 to provide feedback on question 1 and any additional information that may help RAN1 understand the feedback from RAN4.**ACTION 2:** RAN1 respectfully asks RAN4 to provide feedback on question 2 and any additional information that may help RAN1 understand the feedback from RAN4. |

**Feedback Form 3: Please provide your feedback on the above actions:**

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| **Item** | **Company** | **Comments** |
| 1 | CATT | [CATT]Because currently RAN4 has not any concrete agreements for the NTNrequirement of UL time and frequency synchronization, it would be desired to change the wording for action 1, like as:RAN1 respectfully asks RAN4 to provide feedback on question 1 and any ad- ditional information that may help RAN1 understand the NTN requirement of UL time synchronization.for the action 2, it seems so. |

# Inputs on the second variant

The second variant in captured in version 0.0.2. It can be found under the link:

<https://nwm-trial.etsi.org/#/documents/1757>

## Feedback on the introductory text

Based on first round of email discussion, the introductory text is revised as follows:

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| As part of the WI NR-NTN-solution, under agenda item 8.4.2, RAN1 discussed the NTN ULsynchronization requirements in terms of time alignment and frequency error for:• Initial access (i.e. PRACH transmission)• UL transmissions in RRC CONNECTED State.RAN1 has conducted discussion on NTN UL time and frequency synchronization requirements which is captured in the FL Summary of the contributions submitted to TSG-RAN WG1 #104-e **[R1-2102215].**RAN1 identified the following questions that need clarification from RAN4: |

**Feedback Form 1: Please provide your feedback on the introductory text (updated after first round of email discussion)**

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| **Item** | **Company** | **Comments** |
| 1 | ClassonConsult- ing | [for FUTUREWEI] It will be unclear to RAN4 whether we expect them tolook at or consider R1-2102215, and if so which part of the 85 page document they should be looking at, and of that part whether there is any agreed common understanding in RAN1 or not. Our preference is to remove the paragraph with the reference to R1-2102215 and directly include in the LS whatever information we expect them to consider in making the response. |
| 2 | CATT | [CATT] from RAN4 perspective, it may not be necessary to know which agendaor which contribution has discussed the UL time and frequency synchronization issue. Our perference is to only mention the RAN1 has the request to know what is the requirement for UL time and frequency synchronization of NTN. |
| 3 | LG Elec-tronicsInc. | We agree with FUTUREWEI and CATT. We think it is better to ask onlysimple questions, so it would be better not to mention the sentence below.• RAN1 has conducted discussion on NTN UL time and frequency syn- chronization requirements which is captured in the FL Summary of the contributions submitted to TSG-RAN WG1 #104-e **[R1-2102215].** |
| 4 | SamsungElectron- ics Co., Ltd | We think the reference contribution number [R1-2102215] may be helpful forRAN4 to understand the background. However, we also tend to agree the above views in that it could be unnecessary burden to RAN4. We are fine with either way. |
| 5 | THALES | Moderator’s view: The issues related to Time and Frequency synchronizationrequirements are being discussed in RAN4 RRM and RAN4 RF (R4-2103681, R4-2103680, etc..), the intention of the reference to [R1-2102215] is just to share some views captured in RAN1 TDOCS.Of course, this is not necessary and can be simply removed |
| 6 | NokiaDenmark | We support the removal of the reference as highlighted by other companies. |

## Feedback on the questions to RAN4

This section is revised after the first round of email discussion as follows:

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| **Question 1: What are the NTN UL time synchronization requirements?****-For initial access (i.e. PRACH transmission)****-For UL transmissions in RRC Connected State****Question 2: What are the NTN UL frequency synchronization requirements?****-For initial access (i.e. PRACH transmission)****-For UL transmissions in RRC Connected State**Note-1: The questions above are related to the requirements for the signals when they are received at the gNB.Note-2: From RAN1 side we would like to have the requirements such that they are including the”total accumulated error” in both time and frequency domain |

**Feedback Form 2: Please provide your feedback on the two questions (updated based on first round of email discussion)**

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| **Item** | **Company** | **Comments** |
| 1 | CATT | [CATT] for the note 1, it should not focus the signal received in the gNB,instead, the requirement is more related to the test point, which is more aligned with RAN4 language. Based on our understanding, this note is to tell RAN4 the requirement is related to signal reception point at the gNB. So we suggest the following wording:Note-1: The questions above are related to the requirements for signal reception at gNB side. |
| 2 | THALES | Note-1 can be modified as suggested by CATT |
| 3 | MediaTekInc. | Agree Note-1 revision proposed by CATT. To our understanding, RAN4 willeventually specify requirements for UL synchronization for signal reception at the gNB side and define a test accordingly. |
| 4 | SamsungElectron- ics Co., Ltd | We are okay for the revision by CATT. |
| 5 | NokiaDenmark | We are okay for the revision by CATT |

## Feedback on the actions to RAN4

The Actions to RAN4 are the followings:

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| --- |
| **To TSG RAN WG4****ACTION 1:** RAN1 respectfully asks RAN4 to provide feedback on question 1 and any additional information that may help RAN1 understand the feedback from RAN4.**ACTION 2:** RAN1 respectfully asks RAN4 to provide feedback on question 2 and any additional information that may help RAN1 understand the feedback from RAN4 |

**Feedback Form 3: Please provide your feedback on the above actions**

|  |  |  |
| --- | --- | --- |
| **Item** | **Company** | **Comments** |
| 1 | CATT | [CATT]Because currently RAN4 has not any concrete agreements for the NTNrequirement of UL time and frequency synchronization, it would be desired to change the wording for action 1, like as:RAN1 respectfully asks RAN4 to provide feedback on question 1 and any ad- ditional information that may help RAN1 understand the NTN requirement of UL time synchronization.for the action 2, it seems so. |
| 2 | NokiaDenmark | We are supportive of CATT's proposal |

# Final version of the LS

Based on companies inputs the revised draft version is as follows:

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| **3GPP TSG RAN WG1 Meeting #104-e R1-2102263****e-Meeting, January 25 – February 5, 2021** **Title: LS on NTN UL time and frequency synchronization requirements****Release: Rel-17****Work Item: NR\_NTN\_solutions****Source: TSG RAN WG1****To: TSG RAN WG4****Cc:** **Contact Person:** Name:Mohamed EL JAAFARIE-mail Address:**mohamed.el-jaafari@thalesaleniaspace.com****Send any reply LS to: 3GPP Liaisons Coordinator:** **mailto:3GPPLiaison@etsi.org** 1. Overall Description:As part of the WI NR-NTN-solution, under agenda item 8.4.2, RAN1 discussed the NTN UL synchronization requirements in terms of time alignment and frequency error for:• Initial access (i.e. PRACH transmission)• UL transmissions in RRC CONNECTED State. RAN1 identified the following questions that need clarification from RAN4:**Question 1: What are the NTN UL time synchronization requirements?*** **For initial access (i.e. PRACH transmission)**
* **For UL transmissions in RRC Connected State**

**Question 2: What are the NTN UL frequency synchronization requirements?*** **For initial access (i.e. PRACH transmission)**
* **For UL transmissions in RRC Connected State**

Note-1: The questions above are related to the requirements for signal reception at gNB side.Note-2: From RAN1 side we would like to have the requirements such that they are including the ”total accumulated error” in both time and frequency domain.2. Actions:**To TSG RAN WG4****ACTION 1:** RAN1 respectfully asks RAN4 to provide feedback on question 1 and any additional information that may help RAN1 understand the NTN requirement of UL time synchronization. **ACTION 2:** RAN1 respectfully asks RAN4 to provide feedback on question 2 and any additional information that may help RAN1 understand the NTN requirement of UL frequency synchronization3. Date of Next TSG-RAN WG1 Meetings: TSG-RAN WG1 Meeting #104-bis-e 12 Apr. – 20 Apr. 2021 Electronic MeetingTSG-RAN WG1 Meeting #105-e 19 – 27 May 2021 Electronic Meeting |

# References

1. R1-2102215 FL Summary on enhancements on UL time and frequency synchronization for NR NTN THALES