3GPP TSG-RAN WG1 Meeting #109-e R1-22xxxxx

e-Meeting, e-Meeting, May 9th – 20th, 2022

Agenda Item: 8.4

Source: Moderator (Thales)

Title: FL Summary #1: Maintenance on timing relationship enhancements and UL time and frequency synchronization for NR NTN

Document for: Discussion

# Introduction

This feature lead summary document captures the remaining/maintenance issues related to timing relationship enhancements and uplink time and frequency synchronization for NR NTN. It contains a summary of the contributions under 8.4 at TSG-RAN WG1 #109-e together with identified remaining key open issues that will be handled via email discussions.

Based on preparation phase discussion [19, R1-2205120] the following issues will be discussed over email in RAN1#109e:

|  |  |  |
| --- | --- | --- |
| Issue# in [19] | Corresponding Issue# in this document |  |
| 1-02 | Issue#1 | UE behavior w.r.t Validity timer expiry |
| 1-03 | Issue#2 | Ambiguity in the interpretation of SFN indicating Epoch time |
| 1-04 | Issue#3 | Support of negative values of CommonDelayDriftVariation for GEO |
| 1-05 | Issue#4 | Neighbour cell’s epoch time |
| 1-07 | Issue#5 | Correction of value ranges for TACommonDrift and TACommonDriftVariation |
| 1-08 | Issue#6 | Reference Frame for Ephemeris Set 2 – Orbital parameters |
| 1-14 | Issue#7 | Clarification on for MAC-CE Activation/Deactivation |
| 2-03 | Issue#8 | Application time of updated Koffset |
| 1-06 | TP#1 | TP#1 for 3GPP TS 38.213 on Common Delay formula and UE-specific TA |
| 1-10 | TP#2 | TP#2 for 3GPP TS 38.213 on timing relationship in the uplink Power control on PUSCH and PUCCH |
| 1-14 | TP#3 | TP#3 for 3GPP TS 38.214 to clarify MAC-CE Activation/Deactivation |

A total of 18 TDocs have been identified for discussion in [109-e-R17-NR-NTN-01]: please see the Appendix for the details, with all the observations and proposals.

Please note the following checkpoints for agreements:

|  |
| --- |
| [109-e-R17-NR-NTN-01] Email discussion for maintenance on timing relationship enhancements and UL time and frequency synchronization for NR NTN, for issues 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 1-10, 1-14 in R1-2205120, taking into account LS received in R1-2203019 and R1-2203020 – Mohamed (Thales)* 1st check point: May 13 (any RRC impact by May 12)
* Final check point: May 18
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#  [ACTIVE] Issue#1 UE behavior w.r.t Validity timer expiry

## Companies’ contributions summary

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| Huawei, HiSilicon | **Proposal 2:** The network should ensure that the new assistance information is available before expiry of the UL validity timer to reduce the RLF.**Proposal 3:** When new assistance information is available, it up to UE implementation to use the new or old assistance information no matter whether the new UL validity timer starts before or after the expiration of the old validity timer. |
| ZTE | **Proposal 1:** The epoch time tepoch should be set as the start of validity time period. The UL synchronization is thought kept only in the time period , where is the validity duration length.**Proposal 2:** UL synchronization should not be maintained after validity timer expiry.**Proposal 3:** The UE shall re-acquire and apply new assistance information before expiry of UL validity timer. |
| PANASONIC R&D Center Germany | **Proposal 3**: UE may expect that new assistance information is given by the NTN-specific SIB19 [X] seconds earlier than the expiry validity duration given by the previous assistance information.* FFS: options for [X] are 1 sec, 100 ms, 10 ms, or the RRC processing delay. Or it can be defined within RAN4.

**Proposal 4**: UE stops the transmission if new or additional assistance information is not received within the associated validity duration. **Proposal 5:** The assistance information carried in SIB19 or dedicated RRC signaling becomes valid at epoch time. |
| Spreadtrum Communications | **Proposal 2:** If a UE has obtained new serving satellite ephemeris and Common TA related parameters prior to the time of the validity timer expiring, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached. |
| CATT | 1. Updating period of assistant information at satellite should be less than the indicating period of epoch time**.**
2. Configure UE to monitor SIB for new assistant information before validity duration timer expiry.
 |
| xiaomi | **Proposal 2:** The UE suspend the timer when the validity timer is about to expire but the new or additional assistance information is available.**Proposal 3:** It is up to UE implementation to maintain UL synchronization during the period from the expiration time of last UL sync assistance information to the epoch time of new UL sync assistance information. |
| Nokia, Nokia Shanghai Bell | **Proposal 8:** In case of imminent expiry of the validity timer, the UE should have a mechanism to indicate so to the gNB such that corrective actions can be taken.**Proposal 9:** Upon validity timer expiry the UE shall halt any scheduled UL transmissions.**Proposal 10:** Upon expiry of the validity timer, the UE shall reacquire NTN SIB and use the RACH procedure for reacquiring the system synchronization. |
| NEC | **Proposal 1.** The UE shall re-acquire new assistance information before the expiry of the UL validity timer.**Proposal 2.** If a UE has obtained new assistance information prior to the time of the validity timer expiring, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached.**Proposal 3.** The UE suspends the validity timer until the new Epoch time is reached if new NTN assistance information is required before the validity timer expires. |
| Apple | **Proposal 3:** If UE re-acquires assistance information before uplink synchronization validity timer expiry but the new epoch time in the assistance information is after uplink synchronization validity timer expiry, UE suspends uplink transmissions until the new epoch time reaches. * UE does not need to re-acquire additional assistance information
* Validity timer restarts at the new epoch time
 |
| NTT DOCOMO, INC. | **Proposal 3:** Regarding the issue of validity timer expiry, it is clear enough in current spec., and there is no need to further discuss it in RAN1. |
| LG Electronics | Proposal 2. The NTN UE shall re-acquire new assistance information before expiry of UL validity timer.The Epoch time of additional information (e.g., common TA parameters and/or ephemeris information) should be set before expiry of validity timer. |
| THALES | **Proposal 5:*** The UE should re-acquire new assistance information before expiry of UL validity timer.
* If a UE has obtained new serving satellite ephemeris and Common TA related parameters prior to the time of the validity timer expiring and the validity timer expires before new Epoch time is reached, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached. For this, the time interval from the expiration of the validity timer until the new Epoch time must not be larger than the new validity duration. In this case:
	+ The UE suspends the timer during this period such that it does not expire, and restarts the validity timer at the new Epoch time.

Note : UE should always apply new assistance information obtained within uplink sync validity duration.**Proposal 6:** If Proposal 5 is agreed, RAN1 to send an LS to RAN2 to inform RAN2 about the solution agreed in RAN1 to clarify UE behavior when a UE has obtained new serving satellite ephemeris and Common TA related parameters prior to the time of the validity timer expiring and the validity timer expires before the new Epoch time is reached. |
| Ericsson | **Proposal 3** Assistance information with an Epoch time at a future point in time is also valid for a period P before the indicated Epoch time (in addition to a period P after the indicated Epoch time), where P is given by the validity duration parameter.**Proposal 4** If a UE has obtained new assistance information prior to the time of the validity timer of old assistance information expires, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached, under condition that the validity periods of the old and new assistance information overlap. In this case, the UE applies the new assistance information as soon as it is valid, suspends the validity timer during this period such that it does not expire, and restarts the validity timer at the new Epoch time.**Proposal 5** Send an LS to RAN2 to ask them take into account the solution above (assuming it is agreed by RAN1). Due to parallel RAN1/RAN2 meetings, the LS should be sent as soon as possible during the RAN1 meeting. |
| Mavenir | **Proposal 2:** The UE shall re-acquire new assistance information before expiry of UL validity timer. |

## Initial proposal and companies views’ collection for 1st round

Issue#1 was already discussed during last RAN1 meeting but no workaround was agreed. 14 companies provided inputs on this issue within the contributions submitted to RAN1#109e.

Recall of the problem statement: Although UE should attempt to re-acquire SIB19 before the end of the duration indicated by ntnUlSyncValidityDuration and epochTime by UE implementation, it is possible that a UE re-acquires assistance information prior to validity timer expiry, but the new epoch time is after the expiry of the current validity timer. This corner case is illustrated in Figure 1 for UE2.



Figure 1 UE behavior w.r.t Validity timer expiry

To resolve this is issue, the following was proposed/discussed at previous RAN1 meeting: The UE suspends the timer during this period such that it does not expire, and restarts the validity timer at the new Epoch time.

The following views were expressed in the contributions submitted to current meeting:

* **Solution 1**: The UE suspends the timer during this period/ UE is allowed to maintain its UL synchronization**: [PANASONIC, Spreadtrum, xiaomi, NEC, THALES, Ericsson]**
* **Solution 2:** The UE suspends uplink transmissions until the new epoch time reaches**:** [**Huawei, HiSilicon, ZTE, CATT, xiaomi (up to UE implementation), Nokia, Nokia Shanghai Bell, Apple, NTT DOCOMO, LG, Mavenir]**

**Moderator’s view**:

* The common understanding so far is that the uplink sync validity duration is indicated by ntnUlSyncValidityDuration and epochTime and the epoch time determines/defines the start of this validity duration.
* If **solution 1** is adopted, it means as proposed by [**Ericsson**] that assistance information with an Epoch time at a future point in time is also valid for a **period P (=validity duration parameter**) before the indicated Epoch time. That is, forward and backward propagation can have same validity duration length. Nevertheless, as observed by [**ZTE, R1-2203231]** when curve fitting is adopted to extend validity duration of common TA, the validity of backward propagation cannot be guaranteed.
* To adopt **solution 1** we need to determine/characterize the period P (backward propagation duration) which is not necessary equal to ntnUlSyncValidityDuration. Given that we are in maintenance phase, there is no time left to determine such a period and no time left to put more effort on this issue.

The Initial proposal 1 is made as follows, hopefully the group would converge before the first check point for agreement (May 13th ) so a LS can be sent to inform RAN2 about the adopted solution/clarification, if deemed necessary :

**Initial Proposal 1:**

* **Upon validity timer expiry, UE shall suspend uplink transmission and re-acquire SIB19 carrying uplink synchronization assistance information.**
* **If UE re-acquires assistance information before uplink synchronization validity timer expiry but the new epoch time in the assistance information is after uplink synchronization validity timer expiry:**
	+ **UE does not need to re-acquire SIB19**
	+ **UE suspends uplink transmissions until the new epoch time reaches.**

**Note: If this proposal is agreed, a LS should be sent to RAN2 to ask them to take into account this clarification.**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| MediaTek | Generally supportive of the moderator proposal. The second sub-bullet in second bullet is not clear, and may not be needed.  |
| Lenovo | Support moderator’s proposal. |
| Apple | We agree with the proposal in general. We think the first bullet in the proposal is not needed, as it has already been agreed in RAN2.  |

# [ACTIVE] Issue#2 Ambiguity in the interpretation of SFN indicating Epoch time

## Companies’ contributions summary

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| --- | --- |
| **Companies** | **Proposals** |
| Huawei, HiSilicon | **Proposal 4:** If indicated explicitly by a SFN and subframe number, the epoch time t\_epoch is the nearest SFN and subframe number when UE reads the SIB at time t. |
| ZTE | **Proposal 5:** If indicated explicitly by a SFN and subframe number, the Epoch time t\_epoch is the sub-frame which is nearest to the sub-frame where the message indicating the Epoch time is received. |
| PANASONIC R&D Center Germany | **Proposal 6:** If indicated explicitly by SFN and subframe number, epoch time t\_epoch is in the past when UE reads the SIB19 or dedicated RRC signaling at time t where 𝑡\_𝑒𝑝𝑜𝑐ℎ ≤𝑡.**Proposal 7**: Add to SIB-NTN a counter with 7 bits for the SFN-cycles which have elapsed since the epoch time in the first instance of the SIB-NTN in each validity period.  |
| MediaTek Inc. | **Observation 1**: RAN1#108-e proposal 15 Rev 3 “If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received” cannot solve SFN wrapping ambiguity if UE decodes SFN for Epoch time (Epoch time SFN 500) at SIBx SFN (SFN 1012).**Observation 2**: RAN1#108-e proposal 15 Rev 4 “Indicated SFN for Epoch time is current SFN or the next upcoming SFN after the frame where the message indicating the Epoch time is received.” requires longer predicition time with an additional 10.24 s if UE decodes SFN for Epoch time (Epoch time SFN 0) at SIBx SFN (SFN 1).**Proposal 3**: Indicated SFN for Epoch time is, * if (Epoch time SFN- SIBx SFN) is positive choose next epoch time after SIBx SFN (i.e. SFN for epoch time is in the future).
* if (Epoch time SFN- SIBx SFN) is zero choose SIBx SFN (i.e. SFN for epoch time is SIBx SFN ).
* if (Epoch time SFN- SIBx SFN) is negative choose previous epoch time before SIBx SFN (i.e. SFN for epoch time is in the past).

Note 1: SIBx SFN is the last frame where the message indicating the Epoch time is received. |
| xiaomi | **Proposal 1:** If indicated explicitly by a SFN and subframe number the Epoch time t\_epoch is always in the future when UE reads the SIB at time t, where t ≤ t\_epoch.  |
| Nokia, Nokia Shanghai Bell | **Proposal 12:** When indicating Epoch time in an explicit manner, the SFN that is indicated will indicate either current SFN or future SFN’s.**Proposal 13:** No wrap-around for explicit SFN indication is allowed, meaning that the maximum indication of Epoch time into the future would be “SFN-1”, meaning 1023 SFNs into the future. |
| OPPO | **Proposal 7** If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received. |
| Apple | **Proposal 4:** If epoch time is explicitly indicated in the form of SFN and sub-frame, the UE considers the epoch time is in the frame of the indicated SFN value, which is nearest to the frame where the message is received.  |
| NTT DOCOMO, INC. | **Proposal 5:** Indicated SFN for Epoch time is current SFN or the next upcoming SFN after the frame where the message indicating the Epoch time is received. Send LS to RAN2 to inform this modification. |
| THALES | **Proposal 4:** Indicated SFN for Epoch time is current SFN or the next upcoming SFN after the frame where the SIB19-r17 indicating the Epoch time is received. |
| Ericsson | **Observation 1** If the network indicates ephemeris with an Epoch time in the future, the UE can propagate the satellite orbit both backward and forward from this point, and the useful period of the received ephemeris will be significantly longer than with an Epoch time in the past. This benefits both network and UE without significant cost.**Proposal 1** Support indication of explicit Epoch time through the SFN of a future radio frame. |
| Mavenir | **Proposal 3:** If indicated explicitly by a SFN and subframe number the Epoch time t\_epoch is in the future when UE reads the SIB at time t, where t ≤ t\_epoch. |

## Initial proposal and companies views’ collection for 1st round

The issue on a potential ambiguity in the interpretation of the SFN indicating Epoch time was discussed for the first time at previous RAN1 meeting [21]. The following 3 solutions were discussed:

**Solution 1:** If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received.

**Solution 2:** Indicated SFN for Epoch time is current SFN or the next upcoming SFN after the frame where the message indicating the Epoch time is received.

**Solution 3:** If indicated explicitly by SFN and subframe number, epoch time t\_epoch is in the past when UE reads the SIB19 or dedicated RRC signalling at time t where 𝑡\_𝑒𝑝𝑜𝑐ℎ ≤𝑡.

The following views were expressed within the contributions submitted to current meeting:

* Supportive of Solution 1: [**Huawei, HiSilicon, ZTE,** **MediaTek, OPPO, Apple]**
* Supportive of Solution 2: [**xiaomi, Nokia, Nokia Shanghai Bell, NTT DOCOMO, THALES, Ericsson, Mavenir]**
* Supportive of Solution 3: [**PANASONIC]**

**Moderator’s view**: Companies share different views on this topic. From moderator’s perspective:

* Each of the above solutions can resolve the original issue on a possible ambiguity in the interpretation of the SFN indicating Epoch time.

Nevertheless:

* With solutions 1 and 3: the epoch time can be set to be in the past (which means that the network indicates an “outdated” assistance information) , ipso facto, the validity duration is reduced and the UE shall restart at the past its validity duration related timer.
* With solution 2, the epoch time is set at near future which allows to fully utilize the validity duration. It worth noting that this is already the case when Epoch time is implicitly known as the end of the SI window during which the SIB19 is transmitted.

A possible way forward, is to adopt **solution 1** (i.e. reuse the legacy approach for SIB9). If this solution is agreed, to avoid the drawbacks when the epoch time is set in the past and to fully utilize the validity duration, the network can set the epoch time to be in the near future.

With the following proposal, if agreed, the UE behavior on the interpretation of the SFN indicating Epoch time is clear. It is left to the network to either set the epoch time at past or set it at near future.

**Initial Proposal 2:**

**If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received.**

**Note: To fully utilize the validity duration, the network can set the epoch time at near future.**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| MediaTek | It is not clear in moderator’s proposal what is indicated in “**If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received.”**To make progress on this issue, RAN1 could discuss further how the UE determines the SFN for epoch time nearest to the frame where the epoch time is indicated explicitly. We proposed some rules. With these rules the epoch time will be at most 10.24/2=5.12 seconds from the the frame where the epoch time is indicated explicitly. Depending on where the frame where the epoch time is indicated explicitly is received, this would effectively be the nearest frame either in the past or in the future in the range 0, .., 5.12 s. Indicated SFN for Epoch time is, * if (Epoch time SFN- SIBx SFN) is positive choose next epoch time after SIBx SFN (i.e. SFN for epoch time is in the future).
* if (Epoch time SFN- SIBx SFN) is zero choose SIBx SFN (i.e. SFN for epoch time is SIBx SFN ).
* if (Epoch time SFN- SIBx SFN) is negative choose previous epoch time before SIBx SFN (i.e. SFN for epoch time is in the past).

Note 1: SIBx SFN is the last frame where the message indicating the Epoch time is received..  |
| Lenovo | We prefer to follow majority view to support option 2. |
| Apple | We support the proposal.  |

# [ACTIVE- RRC impact] Issue#3 Support of negative values of CommonDelayDriftVariation for GEO

## Companies’ contributions summary

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| --- | --- |
| **Companies** | **Proposals** |
| ZTE | **Proposal 4:** Negative TACommonDriftVariation values should be supported to handle the figure 8 motion in GEO. |
| PANASONIC R&D Center Germany | **Proposal 2**: Add 1 bit for supporting negative TACommonDriftVariation values for GEO. |
| MediaTek Inc. | **Proposal 2**: For GEO for NR NTN:* TACommonDrift with granularity 0.2 \* 1e-4 us/s and range +/-5.24 us/s, bits allocation 19 bits
* TACommonDriftVariation with granularity 2 \* 1e-7 us/s^2 and range +/-3.27 ns/s^2, bits allocation 15 bits
 |
| Nokia, Nokia Shanghai Bell | **Proposal 11:** No need to introduce negative values for TACommonDriftVariation. |
| NTT DOCOMO, INC. | **Proposal 4:** Either to modify the value range and bits allocation of TACommonDriftVariation as value range of - 0.60 µs/  … + 0.60 µs/, and bit allocation of 16 bits, or keep the current value range could be supported. If the value range is modified, send LS to RAN2 to inform this modification. |
| THALES | **Observation 1.** In case of GEO based NTN, NTACommonDriftVariation can be negative. Therefore, if NTACommonDriftVariation is to be indicated in case of GEO, negative TACommonDriftVariation values shall be supported.**Proposal 7:** NTACommonDriftVariation is not indicated in case of GEO based NTN. |
| Ericsson | **Observation 3** The common TA parameter TACommonDriftVariation can have negative values down to approximately -2×10-4 µs/s2 for GEO with large inclination angles.**Proposal 6** For GEO, the common TA parameter TACommonDriftVariation should have a value range of at least (-2×10-4 µs/s2 … 2×10-4 µs/s2) and a granularity of at least ­2×10-7 µs/s2. |
| Mavenir | **Proposal 1:** Add 1 bit for allowing support of negative TACommonDriftVariation values for GEO. |

## Initial proposal and companies views’ collection for 1st round

The granularity and value ranges of common TA parameters were defined/agreed at RAN1#107-e. According to RAN1#107-e agreement, TACommonDriftVariation can only be positive. Such positive values and value range are appropriate in case of LEO based NTN.

However, in case of GEO based NTN, NTACommonDriftVariation can be negative. The support of negative values for TACommonDriftVariation was discussed (for the first time) in previous RAN1 meeting. It was proposed [21] to add 1 bit for allowing support of negative TACommonDriftVariation values for GEO. But there was no consensus and the issue is still open [21].

8 companies provided inputs on this issues within the contributions submitted to RAN1#109-e. The expressed views are as follow:

Companies supportive (or not against) of including negative TACommonDriftVariation to enable long validity duration in GEO: [**ZTE, PANASONIC, MediaTek, NTT DOCOMO, Ericsson, Thales, Mavenir].**

According to **[Nokia, NSB]** there is no need for indicating the 2nd order derivative for the relative stationary GEO case.

To support negative TACommonDriftVariation, some companies proposed to add 1 bit (i.e. bit allocation of 16 bits instead of 15 bits ). As an alternative to adding 1 bit [**Mediatek, Ericsson**] proposed that a **new**/**finer granularity** and range could be considered for CommonDelayDriftVariation for GEO: This would resolve the sign issue, without adding an extra bit and without accuracy loss.

**Moderator’s view**:

* If NTACommonDriftVariation is to be indicated in case of GEO to enable long validity duration, negative TACommonDriftVariation values shall be supported.
* To support negative TACommonDriftVariation values, adding one extra bit would not resolve the issue. In fact, a new granularity and range should be used **specifically for GEO** to ensure common TA estimation during longer duration with sufficient accuracy. However, as already discussed during RAN1#107-e an unified assistance information signalling is adopted so far (and enough to make the system working): same signalling design for LEO, MEO, HAPS and GEO based NTN. Therefore, introducing a new granularity and range specifically for GEO would need more specification effort.
* Further, from Moderator perspective the indication of TACommonDriftVariation might be beneficial only in case of longer prediction time of common delay. For shorter prediction time e.g. up to 900s, indicating TACommonDriftVariation does not improve common delay prediction.

With the above in mind, it is recommended not to indicate NTACommonDriftVariation in case of GEO based NTN unless the above logic is wrong.

The following Initial proposal is made. If this proposal is agreed, the description of NTACommonDriftVariation within the RRC parameter list should be updated. Hopefully the group can converge before 1st check point: May 13 (any RRC impact by May 12)

Initial Proposal 03:

**NTACommonDriftVariation is not indicated in case of GEO based NTN.**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| MediaTek | Not support moderator proposal. We proposed a new range and granularity to avoid significant quantization loss. * TACommonDrift with granularity 0.2 \* 1e-4 us/s and range +/-5.24 us/s, bits allocation 19 bits
* TACommonDriftVariation with granularity 2 \* 1e-7 us/s^2 and range +/-3.27 ns/s^2, bits allocation 15 bits

There is no increase in overhead with the new range and granularity. |
| Lenovo | We prefer MTK’s method to indicate negative value. |

# [ACTIVE- RRC impact] Issue#4 Neighbour cell’s epoch time

## Companies’ contributions summary

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| --- | --- |
| **Companies** | **Proposals** |
| OPPO | 1. During handover, the target cell’s satellite ephemeris, common TA related parameters and the epoch time indication can be provided by the target gNB and then transparently forwarded to UE by the source gNB.
2. When target cell’s epoch time is explicitly provided in handover command, UE follows the target cell’s downlink timing to determine the target cell’s epoch time (i.e. SFN and subframe number).
3. When neighbour cell’s epoch time is explicitly broadcasted for IDLE mode measurement, UE follows the serving cell’s downlink timing to determine the neighbour cell’s epoch time (i.e. SFN and subframe number).
 |
| PANASONIC R&D Center Germany | **Proposal 8:** Because epoch time is expressed by SFN and subframe number which can be different for the respective gNBs, it is necessary clarify which cell’s SFN and subframe number as well as reference point is used as the indication of the epoch time of the neighbor cell.* Option 1: the epoch time for the neighbor cell is based on the SFN and subframe number in the respective neighbor cell. gNB provides relative information to the neighbor cell’s SFN.
* Option 2: the epoch time for the neighbor cell is based on the SFN and subframe number in the current serving cell.
 |

## Initial proposal and companies views’ collection for 1st round

**Moderator’s note**: As discussed in [R1-2202873/ R1-2200883/ R2-2201884] Assistance information (i.e. satellite ephemeris and common TA parameters) of neighbour cell would need to be indicated to UE (via handover command in case of network assisted cell change or via broadcast SI within the serving cell). But there is still an ambiguity on associated Epoch time and related reference point.

It would be necessary to clarify: Whether this epoch time and associated reference point are based on serving cell’s timing or neighbour cell’s timing?

Tow companies provided inputs to RAN1#109e:

* [**OPPO**] proposed that the UE follows the serving cell’s downlink timing to determine the neighbour cell’s epoch time.
* [**PANASONIC**]: proposed two options (Proposal 8 within section 4.1): Epoch time is based on neighbor cell timing (option 1) or Epoch time is based on serving cell timing (option 2).

**Moderator’s view:** The epoch time and associated reference point related to neighbor cell’s ephemeris/common TA parameters should be provided based on serving cell’s timing.

In the light of the above, the following proposal is made. The wording can be further improved if needed.

Hopefully the group would converge before the first check point for agreement (May 13th ) so a LS can be sent to inform RAN2 about the adopted clarification, if deemed necessary.

Initial Proposal 04:

If satellite ephemeris and common TA parameters of neighbour’s cell are indicated to UE:

* **The associated epoch time should be provided based on serving cell’s timing.**
* **The reference point for this epoch time is the uplink time synchronization reference point of serving cell.**

**Note: If this proposal is agreed, a LS should be sent to RAN2 to ask them to take into account this clarification.**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| MediaTek | We wonder if this proposal I needed, and whether RAN2 will be confused by LS. UE pre-compensation is for the serving cell, and already in RAN1 agreement serving cell is clearly mentioned **Agreement*** When explicitly provided through SIB, Epoch time of assistance information (i.e. Serving satellite ephemeris and Common TA parameters) is the starting time of a DL sub-frame, indicated by a SFN and a sub-frame number signaled together with the assistance information.
* Otherwise, when indicated in SIB (other than SIB1), epoch time of assistance information (i.e. Serving satellite ephemeris and Common TA parameters) is implicitly known as the end of the SI window during which the SI message is transmitted.
* When provided through dedicated signaling, epoch time of assistance information (i.e. Serving satellite ephemeris and Common TA parameters) is the starting time of a DL sub-frame, indicated by a SFN and a sub-frame number.
 |
| Lenovo | Support moderator’s proposal. |
| Apple | Agree.  |

#  [ACTIVE- RRC impact] Issue#5 Correction of value ranges for TACommonDrift and TACommonDriftVariation

## Companies’ contributions summary

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| --- | --- |
| **Companies** | **Proposals** |
| MediaTek Inc. | **Proposal 1:** Adopt new range for TACommonDrift - 262143… + 262143 (i.e: 52.42 µs/s … + 52.42 µs/s ) and new range for TACommonDriftVariation 0… 32767 (0… 0.65 µs/s2). |

## Initial proposal and companies views’ collection for 1st round

**[MediaTek]** observed that the range for the TACommonDrift is - 261935… + 261935, however, it should be (–218-1 .. +218-1) which is -262143… +262143. The value range for the TACommonDrift should be (–218-1 .. +218-1)\* 0.2 x 10-3 µs/s = -52.42 µs/s … + 52.42 µs/s.

Similarly, the range for the TACommonDriftVariation should be (0 .. 215-1) which is 0… 32767. The value range for the TACommonDriftVariation should be (0 .. 215-1)\* 0.2 x 10-4 µs/s2 = 0… 0.65 µs/s2.

To correct the value ranges for TACommonDrift and TACommonDriftVariation the following initial proposal is made:

If this proposal is agreed, the description of TACommonDrift and TACommonDriftVariation within the RRC parameter list should be updated. Hopefully the group can converge before 1st check point: May 13 (any RRC impact by May 12)

Initial Proposal 05:

**Adopt new range for TACommonDrift - 262143… + 262143 (i.e.: -52.42 µs/s … + 52.42 µs/s ) and new range for TACommonDriftVariation 0… 32767 (0… 0.65 µs/s2).**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| MediaTek | Support moderator proposal |
| Apple | For “TACommonDrift”, with 19 bits, the integer value range could be [-262144, 262143] (including 0). The corresponding value is [-52.4288, 52.4286] µs/s. Although it is allocated 15 bits for “TACommonDriftVariation”, we do not see the strong motivation to expand the value range to [0, 32767], i.e., using all the possible values.  |

# [ACTIVE] Issue#6 Reference Frame for Ephemeris Set 2 – Orbital parameters

## Companies’ contributions summary

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| MediaTek Inc. | **Proposal** 4: For set 2, RAN1 agree on orbital parameters α , e, ω , Ω , I, and M in Earth Centered Inertial (ECI) Frame* The ECI and ECEF coincide at Epoch time  (e.g. x,y,z axis in ECEF are aligned with x,y,z axis in ECI)
 |

## Initial proposal and companies views’ collection for 1st round

This issue is raised by **MediaTek** in [**5, R1-2203385**].

RAN1#104bis- agreed Support serving-satellite ephemeris broadcast based on ephemeris Set1:PV state vectors or ephemeris Set 2: orbital parameter ephemeris format.

For ephemeris set 1, RAN1 agreed position X,Y,Z in ECEF (m) and velocity VX, VY, Vz in ECEF(m/s).

As raised by [**MediaTek**] for ephemeris set 2, the assumption for (RF) Reference Frame is ambiguous. Without absolute time of ephemeris Set2, the assumption for reference frame needs further discussion.

The following initial is made:

Initial Proposal 06 (MediaTek):

**For ephemeris** **set 2, RAN1 agree on orbital parameters α , e, ω , Ω , I, and M in Earth Centered Inertial (ECI) Frame**

* **The ECI and ECEF coincide at Epoch time  (e.g. x,y,z axis in ECEF are aligned with x,y,z axis in ECI)**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| MediaTek | Support moderator proposal |
|  |  |

# [ACTIVE] Issue#7 Clarification on MAC-CE Activation/Deactivation

## Companies’ contributions summary

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| OPPO | **Proposal 2** Differentiate downlink/uplink slot for MAC-CE activation/deactivation for downlink configuration |

## Initial proposal and companies views’ collection for 1st round

The Issue#7 was discussed/detailed in [R1-2203990, **OPPO**].

[**OPPO**] proposed to differentiate downlink/uplink slot for MAC-CE activation/deactivation for downlink configuration. And proposed a TP for TCI states activation.

**Moderator’s view**: To address the issue raised by [**OPPO]**, clarification on the following agreement made at RAN1 Meeting #105-e might be needed:

|  |
| --- |
| RAN1 Meeting #105-e Agreement:If a UE is provided with a K\_mac value, when the UE would transmit a PUCCH with HARQ-ACK information in uplink slot *n* corresponding to a PDSCH carrying a MAC CE command on a downlink configuration, the UE action and assumption on the downlink configuration shall be applied starting from the first **slot** that is after **slot** , where µ is the SCS configuration for the PUCCH. |

In the above agreement, it is not clear whether the slot highlighted in red is referring to the downlink or the uplink.

In NTN, It might be understood, UE would transmit HARQ-ACK in **uplink** slot *n* and apply the MAC-CE from the first **downlink** slot that is after **downlink** slot .

But, as observed by [**OPPO**] current spec does not differentiate whether a downlink slot or an uplink slot should be assumed, this would cause confusion for a reader without NTN context as a large TA gap exists between a downlink slot and an uplink slot with the same slot index.

To clarify this issue, we may first need to modify the agreement made at RAN1 Meeting #105-e. Then, propose relevant TPs/CRs to be communicated to the specs editors. The one on TCI states activation is given section **11.2**.

Initial Proposal 7:

**Modify the agreement made at RAN1 Meeting #105-e as follows:**

**If a UE is provided with a K\_mac value, when the UE would transmit a PUCCH with HARQ-ACK information in uplink slot *n* corresponding to a PDSCH carrying a MAC CE command on a downlink configuration, the UE action and assumption on the downlink configuration shall be applied starting from the first downlink slot that is after downlink slot , where µ is the SCS configuration for the PUCCH.**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| Lenovo | Support |
| Apple | We think it is “starting from the first downlink slot that is after uplink slot , where µ is the SCS configuration for the PUCCH.” Since PUCCH SCS is used here, the slot index of is in uplink slot.Overall, the downlink configuration MAC CE is applied in downlink slot. Hence, the first addition of “downlink” seems unnecessary. Also, the slot *n* is indicated as uplink slot, hence, the second addition of “uplink” is also not mandatory.  |

#  [ACTIVE] Issue#8 Application time of updated Koffset

## Companies’ contributions summary

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| Qualcomm Incorporated | **Proposal 2:** For DCI scheduled PUSCH including CSI on PUSCH and aperiodic SRS and for HARQ-ACK on PUCCH, the Koffset that is valid at the slot of the associated DCI being received is applied.  |

## Initial proposal and companies views’ collection for 1st round

This issue is raised by **Qualcomm** in [**R1-2204984**].

When updated by MAC CE command, the application time of the new Koffset is defined as [**R1-2202984**]:

If the UE is provided a value by a MAC CE command, the UE applies the MAC command in the first slot that is after slot where is the slot where the UE would transmit a PUCCH with HARQ-ACK information for the PDSCH providing the MAC CE command, is the SCS configuration for the PUCCH transmission that is determined in the slot when the MAC CE command is applied.

As observed by [**Qualcomm]** when the scheduling PDCCH comes before the defined application time, and the scheduled PUCCH/PUSCH is after the application time, it’s unclear if the new or old Koffset should be used. In fact, the transmit time of PUCCH and PUSCH depends on the value of the Koffset. This ambiguity exists in the following cases:

* The transmission timing of DCI scheduled PUSCH (including CSI on PUSCH).
* The transmission timing of HARQ-ACK on PUCCH (including PUCCH in response to MsgB).
* The transmission timing of aperiodic SRS.

To solve the above ambiguity issue, the following initial proposal is made:

Initial Proposal 8 (Qualcomm):

**For DCI scheduled PUSCH including CSI on PUSCH and aperiodic SRS and for HARQ-ACK on PUCCH, the Koffset that is valid at the slot of the associated DCI being received is applied.**

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| Lenovo | We have a different view. We think the updated K-offset can be based on PUSCH/PUCCH transmission rather than DCI reception. The reason is that although the time domain order is PDCCH, application of K-offset, PUSCH/PUCCH transmission, if gNB and UE has common understanding on the uplink transmission timing, the system can work well. |
| Apple | Fine with the proposal.  |

#  [ACTIVE] TP#1 for 3GPP TS 38.213 on Common Delay formula and UE-specific TA

## Companies’ contributions summary

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| Spreadtrum Communications | **Proposal 3:** Adopt the text proposal in section 3 ([**R1-2203306**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203306.zip)**)** |
| MediaTek Inc. | **Proposal 2**: Support Modified proposal 12 (rev 1) and TP for 3GPP TS 38.213 for the formula of as proposed in FL summary in RAN1#108-e. |
| Sony | **Proposal 1:** The agreed equation of and epoch time definition in RAN1 107-e should be captured in specification.**Proposal 2:** Following the text proposal can be considered for TS38.213 specification:

|  |
| --- |
| --------------------------------- Start of TP for 3GPP TS 38.213 ----------------------------------* **4.2  Transmission timing adjustments**

<Unchanged Text Omitted>A UE can be provided a value of a timing advance offset for a serving cell by n-TimingAdvanceOffset for the serving cell. If the UE is not provided n-TimingAdvanceOffset for a serving cell, the UE determines a default value of the timing advance offset for the serving cell as described in [10, TS 38.133]. If a UE is configured with two UL carriers for a serving cell, a same timing advance offset value applies to both carriers. Upon reception of a timing advance command for a TAG, the UE adjusts uplink timing for PUSCH/SRS/PUCCH transmission on all the serving cells in the TAG based on a value that the UE expects to be same for all the serving cells in the TAG and based on the received timing advance command where the uplink timing for PUSCH/SRS/PUCCH transmissions is the same for all the serving cells in the TAG. For a band with synchronous contiguous intra-band EN-DC in a band combination with non-applicable maximum transmit timing difference requirements as described in Note 1 of Table 7.5.3-1 of [10, TS 38.133], if the UE indicates ul-TimingAlignmentEUTRA-NR as ‘required’ and uplink transmission timing based on timing adjustment indication for a TAG from MCG and a TAG from SCG are determined to be different by the UE, the UE adjusts the transmission timing for PUSCH/SRS/PUCCH transmission on all serving cells part of the band with the synchronous contiguous intra-band EN-DC based on timing adjustment indication for a TAG from a serving cell in MCG in the band. The UE is not expected to transmit a PUSCH/SRS/PUCCH in one CG when the PUSCH/SRS/PUCCH is overlapping in time, even partially, with random access preamble transmitted in another CG.To pre-compensate the two-way transmission delay between the uplink time synchronisation reference point and the satellite, is derived by the UE based on ,which can be obtained as:where is the epoch time of the higher-layer parameters TACommon, TACommonDrift, and TACommonDriftVariation.This gives the distance at time between the satellite and the uplink time synchronisation reference point divided by the speed of light.The uplink time synchronisation reference point is the point at which DL and UL are frame aligned with an offset given by .The UE shall derive based on to pre-compensate the two-way transmission delay between the uplink time synchronisation reference point and the satellite.For a SCS of cid:image039.png@01D82EED.31ED45F0 kHz, the timing advance command for a TAG indicates the change of the uplink timing relative to the current uplink timing for the TAG in multiples of cid:image040.png@01D82EED.31ED45F0. The start timing of the random access preamble is described in [4, TS 38.211].---------------------------------- End of TP for 3GPP TS 38.213 --------------------------------- |

 |
| THALES | **Proposal 1:** Adopt the TP for 3GPP TS 38.213 given in section 2 of this contribution ([**R1-2204556**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204556.zip)**)** |
| Ericsson | **Proposal 7** Adopt the following TP for 3GPP TS 38.213:

|  |
| --- |
| --------------------------------- Start of TP for 3GPP TS 38.213 ----------------------------------**4.2  Transmission timing adjustments**<Unchanged Text Omitted>Using higher-layer ephemeris parameters for the serving satellite, if configured, the UE calculates , using serving satellite position and its own position, to pre-compensate the two-way transmission delay on the service link.To pre-compensate the two-way transmission delay between the uplink time synchronization reference point and the satellite, is derived by the UE based on ,which can be obtained as:[where](#_Toc101796890)  is the Epoch time of the higher-layer parameters *TACommon*, *TACommonDrift*, and *TACommonDriftVariation.*[This](#_Toc101796890)  gives the distance at time between the satellite and the uplink time synchronization reference point divided by the speed of light.The uplink time synchronization reference point is the point at which DL and UL are frame aligned with an offset given by .---------------------------------- End of TP for 3GPP TS 38.213 --------------------------------- |

 |

## Initial proposal and companies views’ collection for 1st round

**Moderator’s note**: The TP for 3GPP TS 38.213 on Common Delay formula and UE-specific TA was discussed in previous RAN1 meeting [21] but not endorsed.

The formula of agreed in RAN1#107-e is essential because it provides how the UE interprets/uses the Common TA related parameters indicated by the Network. It is also used by the UE to compute/derive the . Therefore, the agreement on made at RAN1#107e-meeting should be captured in the specifications.

Initial Proposal 09:

**Adopt the following TP for 3GPP TS 38.213:**

|  |
| --- |
| --------------------------------- Start of TP for 3GPP TS 38.213 ----------------------------------**4.2  Transmission timing adjustments**<Unchanged Text Omitted>Using higher-layer ephemeris parameters for the serving satellite, if configured, the UE calculates , using serving satellite position and its own position, to pre-compensate the two-way transmission delay on the service link.To pre-compensate the two-way transmission delay between the uplink time synchronization reference point and the satellite, is derived by the UE based on ,which can be obtained as:where is the epoch time of the higher-layer parameters *TACommon*, *TACommonDrift*, and *TACommonDriftVariation.*This gives the distance at time between the satellite and the uplink time synchronization reference point divided by the speed of light.The uplink time synchronization reference point is the point at which DL and UL are frame aligned with an offset given by .---------------------------------- End of TP for 3GPP TS 38.213 --------------------------------- |

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| MediaTek | Support moderator proposal |
| Lenovo | Support. |
| Apple | Fine with the proposal.  |

#  [ACTIVE] TP#2 for 3GPP TS 38.213 on timing relationship in the uplink Power control on PUSCH and PUCCH

## Companies’ contributions summary

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| CATT | 1. Adopt the above CRs (refer to [**R1-2203756**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203756.zip)**)** about timing relationship descriptions in the uplink power control.
 |

## Initial proposal and companies views’ collection for 1st round

[**CATT**] observed that timing relationship in the uplink Power control on PUSCH and PUCCH should be considered in NTN specific scenario. But based on latest specification CR (R1-2202984 Corrections on non-terrestrial network operation in NR ), the timing relationship in the uplink power control has not been modified. This issue should be fixed and the detailed description about timing relationship should be specified in 38.213.

[**CATT**] proposed the following TPs for TS 38.213.

Initial Proposal 10 (CATT):

**Adopt the following TPs for 3GPP TS 38.213**

**- on PUSCH power control with added wording in red color:**

|  |
| --- |
| 7.1.1 UE behaviour\*\*\* Unchanged text is omitted \*\*\*-  is the PUSCH power control adjustment state  for active UL BWP  of carrier  of serving cell  and PUSCH transmission occasion  if the UE is not provided *tpc-Accumulation*, where - The  values are given in Table 7.1.1-1-  is a sum of TPC command values in a set  of TPC command values with cardinality  that the UE receives between  symbols before PUSCH transmission occasion  and  symbols before PUSCH transmission occasion  on active UL BWP  of carrier  of serving cell  for PUSCH power control adjustment state , where  is the smallest integer for which  symbols before PUSCH transmission occasion  is earlier than  symbols before PUSCH transmission occasion - If a PUSCH transmission is scheduled by a DCI format 0\_0 or DCI format 0\_1,  is a number of symbols for active UL BWP  of carrier  of serving cell  after a last symbol of a corresponding PDCCH reception and before a first symbol of the PUSCH transmission - If a PUSCH transmission is configured by *ConfiguredGrantConfig*,  is a number of  symbols equal to the product of a number of symbols per slot, , and the minimum of the values provided by , where *k2* is provided by *PUSCH-ConfigCommon* for active UL BWP  of carrier  of serving cell  , and , where is provided by *CellSpecificKoffset* and is provided by a MAC CE command; otherwise, if not respectively provided, or .\*\*\* Unchanged text is omitted \*\*\* |

**- on PUCCH power control with added wording in red color:**

|  |
| --- |
| **7.2.1 UE behaviour**\*\*\* Unchanged text is omitted \*\*\* is the current PUCCH power control adjustment state  for active UL BWP  of carrier  of serving cell  and PUCCH transmission occasion , where - The  values are given in Table 7.1.2-1-  is a sum of TPC command values in a set  of TPC command values with cardinality  that the UE receives between  symbols before PUCCH transmission occasion  and  symbols before PUCCH transmission occasion  on active UL BWP  of carrier  of serving cell  for PUCCH power control adjustment state, where  is the smallest integer for which  symbols before PUCCH transmission occasion  is earlier than  symbols before PUCCH transmission occasion - If the PUCCH transmission is in response to a detection by the UE of a DCI format 1\_0 or DCI format 1\_1,  is a number of symbols for active UL BWP  of carrier  of serving cell  after a last symbol of a corresponding PDCCH reception and before a first symbol of the PUCCH transmission- If the PUCCH transmission is not in response to a detection by the UE of a DCI format 1\_0 or DCI format 1\_1,  is a number of  symbols equal to the product of a number of symbols per slot, , and the minimum of the values provided by , where *k2* is provided by *PUSCH-ConfigCommon* for active UL BWP  of carrier  of serving cell ,, and , where is provided by *CellSpecificKoffset* and is provided by a MAC CE commond; otherwise, if not respectively provided, or .\*\*\* Unchanged text is omitted \*\*\* |

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| Apple | Fine with the proposal. |
|  |  |

# [ACTIVE] TP#3 for 3GPP TS 38.214 to clarify MAC-CE Activation/Deactivation

## Companies’ contributions summary

|  |  |
| --- | --- |
| **Companies** | **Proposals** |
| OPPO | **Proposal 2** Differentiate downlink/uplink slot for MAC-CE activation/deactivation for downlink configuration |

## Initial proposal and companies views’ collection for 1st round

The following TP on TCI states activation is related to the Issue#7-Clarification on MAC-CE Activation/Deactivation.

Initial Proposal 11:

**Adopt the following TP for 3GPP TS 38.214:**

|  |
| --- |
| -------------------- Start of TP for TS 38.214 V17.1.0 ---------------------------5.1.5 Antenna ports quasi co-location<Unchanged parts are omitted>When the UE would transmit a PUCCH with HARQ-ACK information in uplink slot *n* corresponding to the PDSCH carrying the activation command, the indicated mapping between TCI states and codepoints of the DCI field *'Transmission Configuration Indication'* should be applied starting from the first downlink slot that is after downlink slot where ** is the SCS configuration for the PUCCH and is the subcarrier spacing configuration for with a value of 0 for frequency range 1, and is provided by *K-Mac* or if *K-Mac* is not provided. If *tci-PresentInDCI* is set to 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET scheduling the PDSCH, and the time offset between the reception of the DL DCI and the corresponding PDSCH is equal to or greater than *timeDurationForQCL* if applicable, after a UE receives an initial higher layer configuration of TCI states and before reception of the activation command, the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the SS/PBCH block determined in the initial access procedure with respect to *qcl-Type* set to 'typeA', and when applicable, also with respect to *qcl-Type* set to 'typeD'.--------------------End of TP for TS 38.214 V17.1.0 --------------------------------- |

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| Lenovo | We think current spec is clear enough. As the A/N is anyway transmitted in a uplink slot, and PDSCH is anyway received in a downlink.  |
| Apple | We do not think the changes are needed. By default, PUCCH is transmitted in uplink slot, and the TCI state is updated in downlink slot. Also, the slot seems to be in uplink slot.  |

# Conclusion

TBC

# References

1. R1-2203088 Maintenance on solutions for NR to support NTN Huawei, HiSilicon
2. R1-2203231 Remaining issues on NR-NTN ZTE
3. R1-2203289 Maintenance on Solutions for NR to support non-terrestrial networks (NTN) PANASONIC R&D Center Germany
4. R1-2203306 Maintenance on Solutions for NR to support non-terrestrial networks (NTN) Spreadtrum Communications
5. R1-2203385 Maintenance on Solutions for NR to support NTN MediaTek Inc.
6. R1-2203721 Discussion on ambiguity of common TA calculation Sony
7. R1-2203756 Maintenance on NR NTN CATT
8. R1-2203770 Discussion on maintenance issues in NR-NTN xiaomi
9. R1-2203843 Maintenance aspects af Rel-17 NR over NTN Nokia, Nokia Shanghai Bell
10. R1-2203935 Discussion on the remaining issues in R17 NR NTN NEC
11. R1-2203990 Discussion on remaining issue for NTN-NR OPPO
12. R1-2204207 On remaining issues of NR NTN Apple
13. R1-2204345 Remaining issues on NR NTN NTT DOCOMO, INC.
14. R1-2204519 Remaining issues on UL time and frequency synchronization enhancements in NTN LG Electronics
15. R1-2204556 Maintenance on Release-17 NR NTN THALES
16. R1-2204660 On NR NTN maintenance issues Ericsson
17. R1-2204933 Enhancements on UL time and frequency synchronization Mavenir
18. R1-2204984 Maintenance on NR NTN Qualcomm Incorporated
19. R1-2205120 Moderator Summary for preparation phase on maintenance of Rel-17 WI on Solutions for NR to support non-terrestrial networks (NTN)
20. R1-2202910 3GPP TSG-RAN WG1 Agreements under 8.4 up to eMeeting RAN1#108-e
21. FL Summary #4: Maintenance on UL time and frequency synchronization for NR NTN, Moderator (Thales), March 2022

#  Appendix I: RAN1 agreements on UL time and frequency synchronization for NR NTN

TSG-RAN1 Agreements can be found in [20, R1-2202910]

# Appendix II: Summary of proposals

|  |  |  |
| --- | --- | --- |
| **TDoc** | **Source** | **Proposals and observations** |
| [**R1-2203088**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203088.zip) | Huawei, HiSilicon | **Observation 1:** Introducing a negative NTA may avoid the early arrival of PRACH but it cannot help with UL performance degradation in FR2 assuming the same serving-satellite position estimation error and GNSS accuracy as FR1.**Observation 2:** The requirement of GNSS accuracy and serving-satellite position estimation error may anyway need to be tighter in FR2 than FR1 due to the shorter CP length.**Proposal 1:** Confirm the working assumption below1. Working assumption:

When TAC () in msg2/msgB is received, UE receives the first adjustment and is updated as:* Option 1: .

Where, is the TAC field in msg2/msgBWhere, is the TAC field in msg2/msgB**Proposal 2:** The network should ensure that the new assistance information is available before expiry of the UL validity timer to reduce the RLF.**Proposal 3:** When new assistance information is available, it up to UE implementation to use the new or old assistance information no matter whether the new UL validity timer starts before or after the expiration of the old validity timer.**Proposal 4:** If indicated explicitly by a SFN and subframe number, the epoch time t\_epoch is the nearest SFN and subframe number when UE reads the SIB at time t.**Proposal 5:** When epoch time of assistance information is implicitly known as the end of the SI window, allow the assistance information to be repeated among different SI windows and the epoch time is defined as the end of the first SI window during one update period. |
| [**R1-2203231**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203231.zip) | ZTE | **Proposal 1:** The epoch time tepoch should be set as the start of validity time period. The UL synchronization is thought kept only in the time period , where is the validity duration length.**Proposal 2:** UL synchronization should not be maintained after validity timer expiry.**Proposal 3:** The UE shall re-acquire and apply new assistance information before expiry of UL validity timer.**Proposal 4:** Negative TACommonDriftVariation values should be supported to handle the figure 8 motion in GEO.**Proposal 5:** If indicated explicitly by a SFN and subframe number, the Epoch time t\_epoch is the sub-frame which is nearest to the sub-frame where the message indicating the Epoch time is received. |
| [**R1-2203289**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203289.zip) | PANASONIC R&D Center Germany | **Proposal 1:** Confirm the working assumption:When TAC () in msg2/msgB is received, UE receives the first adjustment and is updated as:* Option 1: .

Where, is the TAC field in msg2/msgB**Proposal 2**: Add 1 bit for supporting negative TACommonDriftVariation values for GEO.**Proposal 3**: UE may expect that new assistance information is given by the NTN-specific SIB19 [X] seconds earlier than the expiry validity duration given by the previous assistance information.* FFS: options for [X] are 1 sec, 100 ms, 10 ms, or the RRC processing delay. Or it can be defined within RAN4.

**Proposal 4**: UE stops the transmission if new or additional assistance information is not received within the associated validity duration. **Proposal 5:** The assistance information carried in SIB19 or dedicated RRC signaling becomes valid at epoch time.**Proposal 6:** If indicated explicitly by SFN and subframe number, epoch time t\_epoch is in the past when UE reads the SIB19 or dedicated RRC signaling at time t where 𝑡\_𝑒𝑝𝑜𝑐ℎ ≤𝑡.**Proposal 7**: Add to SIB-NTN a counter with 7 bits for the SFN-cycles which have elapsed since the epoch time in the first instance of the SIB-NTN in each validity period. **Proposal 8:** Because epoch time is expressed by SFN and subframe number which can be different for the respective gNBs, it is necessary clarify which cell’s SFN and subframe number as well as reference point is used as the indication of the epoch time of the neighbor cell.* Option 1: the epoch time for the neighbor cell is based on the SFN and subframe number in the respective neighbor cell. gNB provides relative information to the neighbor cell’s SFN.
* Option 2: the epoch time for the neighbor cell is based on the SFN and subframe number in the current serving cell.
 |
| [**R1-2203306**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203306.zip) | Spreadtrum Communications | **Proposal 1: Confirm the Working assumption on TA update in RRC\_CONNECTED state:****Working assumption:**When TAC () in msg2/msgB is received, UE receives the first adjustment and is updated as:* Option 1: .

where, is the TAC field in msg2/msgB**Proposal 2:** If a UE has obtained new serving satellite ephemeris and Common TA related parameters prior to the time of the validity timer expiring, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached.**Proposal 3:** Adopt the text proposal in section 3**.** |
| [**R1-2203385**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203385.zip) | MediaTek Inc. | For Time and frequency synchronisation:**Proposal 1:** Adopt new range for TACommonDrift - 262143… + 262143 (i.e: 52.42 µs/s … + 52.42 µs/s ) and new range for TACommonDriftVariation 0… 32767 (0… 0.65 µs/s2).**Proposal 2**: Support Modified proposal 12 (rev 1) and TP for 3GPP TS 38.213 for the formula of as proposed in FL summary in RAN1#108-e.**Proposal 2**: For GEO for NR NTN:* TACommonDrift with granularity 0.2 \* 1e-4 us/s and range +/-5.24 us/s, bits allocation 19 bits
* TACommonDriftVariation with granularity 2 \* 1e-7 us/s^2 and range +/-3.27 ns/s^2, bits allocation 15 bits

**Observation 1**: RAN1#108-e proposal 15 Rev 3 “If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received” cannot solve SFN wrapping ambiguity if UE decodes SFN for Epoch time (Epoch time SFN 500) at SIBx SFN (SFN 1012).**Observation 2**: RAN1#108-e proposal 15 Rev 4 “Indicated SFN for Epoch time is current SFN or the next upcoming SFN after the frame where the message indicating the Epoch time is received.” requires longer predicition time with an additional 10.24 s if UE decodes SFN for Epoch time (Epoch time SFN 0) at SIBx SFN (SFN 1).**Proposal 3**: Indicated SFN for Epoch time is, * if (Epoch time SFN- SIBx SFN) is positive choose next epoch time after SIBx SFN (i.e. SFN for epoch time is in the future).
* if (Epoch time SFN- SIBx SFN) is zero choose SIBx SFN (i.e. SFN for epoch time is SIBx SFN ).
* if (Epoch time SFN- SIBx SFN) is negative choose previous epoch time before SIBx SFN (i.e. SFN for epoch time is in the past).

Note 1: SIBx SFN is the last frame where the message indicating the Epoch time is received.**Proposal** 4: For set 2, RAN1 agree on orbital parameters α , e, ω , Ω , I, and M in Earth Centered Inertial (ECI) Frame* The ECI and ECEF coincide at Epoch time  (e.g. x,y,z axis in ECEF are aligned with x,y,z axis in ECI)

For Timing relationships: **Proposal 5:** Wait for RAN2's reply to the cell-specific K\_offset ambiguity issue during the SIB modification period. |
| [**R1-2203721**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203721.zip) | Sony | **Proposal 1:** The agreed equation of and epoch time definition in RAN1 107-e should be captured in specification.Proposal 2: Following the text proposal can be considered for TS38.213 specification:

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| --------------------------------- Start of TP for 3GPP TS 38.213 ----------------------------------* **4.2  Transmission timing adjustments**

<Unchanged Text Omitted>A UE can be provided a value of a timing advance offset for a serving cell by n-TimingAdvanceOffset for the serving cell. If the UE is not provided n-TimingAdvanceOffset for a serving cell, the UE determines a default value of the timing advance offset for the serving cell as described in [10, TS 38.133]. If a UE is configured with two UL carriers for a serving cell, a same timing advance offset value applies to both carriers. Upon reception of a timing advance command for a TAG, the UE adjusts uplink timing for PUSCH/SRS/PUCCH transmission on all the serving cells in the TAG based on a value that the UE expects to be same for all the serving cells in the TAG and based on the received timing advance command where the uplink timing for PUSCH/SRS/PUCCH transmissions is the same for all the serving cells in the TAG. For a band with synchronous contiguous intra-band EN-DC in a band combination with non-applicable maximum transmit timing difference requirements as described in Note 1 of Table 7.5.3-1 of [10, TS 38.133], if the UE indicates ul-TimingAlignmentEUTRA-NR as ‘required’ and uplink transmission timing based on timing adjustment indication for a TAG from MCG and a TAG from SCG are determined to be different by the UE, the UE adjusts the transmission timing for PUSCH/SRS/PUCCH transmission on all serving cells part of the band with the synchronous contiguous intra-band EN-DC based on timing adjustment indication for a TAG from a serving cell in MCG in the band. The UE is not expected to transmit a PUSCH/SRS/PUCCH in one CG when the PUSCH/SRS/PUCCH is overlapping in time, even partially, with random access preamble transmitted in another CG.To pre-compensate the two-way transmission delay between the uplink time synchronisation reference point and the satellite, is derived by the UE based on ,which can be obtained as:where is the epoch time of the higher-layer parameters TACommon, TACommonDrift, and TACommonDriftVariation.This gives the distance at time between the satellite and the uplink time synchronisation reference point divided by the speed of light.The uplink time synchronisation reference point is the point at which DL and UL are frame aligned with an offset given by .The UE shall derive based on to pre-compensate the two-way transmission delay between the uplink time synchronisation reference point and the satellite.For a SCS of  kHz, the timing advance command for a TAG indicates the change of the uplink timing relative to the current uplink timing for the TAG in multiples of . The start timing of the random access preamble is described in [4, TS 38.211].---------------------------------- End of TP for 3GPP TS 38.213 --------------------------------- |

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| [**R1-2203756**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203756.zip) | CATT | 1. Updating period of assistant information at satellite should be less than the indicating period of epoch time**.**
2. Configure UE to monitor SIB for new assistant information before validity duration timer expiry.

Regarding the timing relationship enhancement for NTN, one issue for power control has been identified, we propose one CR for 38.213 to be adopted.1. Adopt the following CRs about timing relationship descriptions in the uplink power control.

Updated CR 38.213 on PUSCH and PUCCH power control with added wording in red color:

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| 7.1.1 UE behaviour\*\*\* Unchanged text is omitted \*\*\*-  is the PUSCH power control adjustment state  for active UL BWP  of carrier  of serving cell  and PUSCH transmission occasion  if the UE is not provided *tpc-Accumulation*, where - The  values are given in Table 7.1.1-1-  is a sum of TPC command values in a set  of TPC command values with cardinality  that the UE receives between  symbols before PUSCH transmission occasion  and  symbols before PUSCH transmission occasion  on active UL BWP  of carrier  of serving cell  for PUSCH power control adjustment state , where  is the smallest integer for which  symbols before PUSCH transmission occasion  is earlier than  symbols before PUSCH transmission occasion - If a PUSCH transmission is scheduled by a DCI format 0\_0 or DCI format 0\_1,  is a number of symbols for active UL BWP  of carrier  of serving cell  after a last symbol of a corresponding PDCCH reception and before a first symbol of the PUSCH transmission - If a PUSCH transmission is configured by *ConfiguredGrantConfig*,  is a number of  symbols equal to the product of a number of symbols per slot, , and the minimum of the values provided by , where *k2* is provided by *PUSCH-ConfigCommon* for active UL BWP  of carrier  of serving cell  , and , where is provided by *CellSpecificKoffset* and is provided by a MAC CE commond; otherwise, if not respectively provided, or .\*\*\* Unchanged text is omitted \*\*\***7.2.1 UE behaviour**\*\*\* Unchanged text is omitted \*\*\* is the current PUCCH power control adjustment state  for active UL BWP  of carrier  of serving cell  and PUCCH transmission occasion , where - The  values are given in Table 7.1.2-1-  is a sum of TPC command values in a set  of TPC command values with cardinality  that the UE receives between  symbols before PUCCH transmission occasion  and  symbols before PUCCH transmission occasion  on active UL BWP  of carrier  of serving cell  for PUCCH power control adjustment state, where  is the smallest integer for which  symbols before PUCCH transmission occasion  is earlier than  symbols before PUCCH transmission occasion - If the PUCCH transmission is in response to a detection by the UE of a DCI format 1\_0 or DCI format 1\_1,  is a number of symbols for active UL BWP  of carrier  of serving cell  after a last symbol of a corresponding PDCCH reception and before a first symbol of the PUCCH transmission- If the PUCCH transmission is not in response to a detection by the UE of a DCI format 1\_0 or DCI format 1\_1,  is a number of  symbols equal to the product of a number of symbols per slot, , and the minimum of the values provided by , where *k2* is provided by*PUSCH-ConfigCommon* for active UL BWP  of carrier  of serving cell ,, and , where is provided by *CellSpecificKoffset* and is provided by a MAC CE commond; otherwise, if not respectively provided, or .\*\*\* Unchanged text is omitted \*\*\* |  |

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| [**R1-2203770**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203770.zip) | xiaomi | **Proposal 1:** If indicated explicitly by a SFN and subframe number the Epoch time t\_epoch is always in the future when UE reads the SIB at time t, where t ≤ t\_epoch. **Proposal 2:** The UE suspend the timer when the validity timer is about to expire but the new or additional assistance information is available.**Proposal 3:** It is up to UE implementation to maintain UL synchronization during the period from the expiration time of last UL sync assistance information to the epoch time of new UL sync assistance information. |
| [**R1-2203843**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203843.zip) | Nokia, Nokia Shanghai Bell | **Observation 1**: Operation of closed loop and open loop TA control in RRC connected state needs careful design to avoid instability due to erroneous calculation of the UE-specific TA value by the UE.**Observation 2**: In order to guarantee TA update loop stability, it is preferred to have well-defined UE behavior when updating the serving satellite ephemeris and common TA information.**Observation 3**: A gNB may need to provide different values for cell-specicif K\_offset during a satellite fly-over for earth-fixed cells.**Observation 4**: A UE receiving the SI via dedicated RRC message may acquire a cell-specific K\_offset in a different point of time compared to the other UEs. **Observation 5**: A UE may fail to obtain the updated SI within the first SI-window for the SIB containing the NTN parameters such as cell-specific K\_offset in the modification period. **Observation 6**: The gNB will be unaware of the times where the UE reads the NTN SIB.**Observation 7**: The gNB is unaware of when the UE will lose its UL synchronization due to validity timer expiry.**Observation 8**: The gNB will in general stop scheduling a UE that becomes non-responsive, no matter the reason behind this.**Observation 9**: Serving satellite ephemeris information is symmetrical around the position and allows the UE to predict accurately into the both negative and positive time relative to the Epoch time.**Observation 10**: Applying an Epoch time that is in the past will cause more than half of the information content to be discarded.**Proposal 1**: The update rate that the UE applies for both the UE-specific TA and Common TA should be such that the applied TA fulfilles the RAN4 time synchronization requirements.**Proposal 2**: For UE in RRC connected mode, in case closed loop TA control is used, open loop TA control should be applied only in a way that does not impact the stability and accuracy as provided by closed loop TA control.**Proposal 3**: When applying updated Common TA parameters or serving satellite epehemris information, the UE shall reset the impacts by received TA commands during the operation.**Proposal 4**: Adopt TP1 for 38.211.\*\*\* Begin TP1 for 38.211, v. 17.1.0 \*\*\*4.3.1 Frames and subframesDownlink, uplink, and sidelink transmissions are organized into frames with  duration, each consisting of ten subframes of  duration. The number of consecutive OFDM symbols per subframe is . Each frame is divided into two equally-sized half-frames of five subframes each with half-frame 0 consisting of subframes 0 – 4 and half-frame 1 consisting of subframes 5 – 9.There is one set of frames in the uplink and one set of frames in the downlink on a carrier. Uplink frame number  for transmission from the UE shall start before the start of the corresponding downlink frame at the UE where- and are given by clause 4.2 of [5, TS 38.213], except for msgA transmission on PUSCH where shall be used;- is derived from the higher-layer parameters TACommon, TACommonDrift, and TACommonDriftVariation if configured, otherwise ;- is computed by the UE based on UE position and serving-satellite-ephemeris-related higher-layers parameters if configured, otherwise .Figure 4.3.1-1: Uplink-downlink timing relation.When updating and , the UE shall subtract any impact to which has been caused by systematic errors in the UE estimating these values.\*\*\* End TP1 for 38.211, v. 17.1.0 \*\*\***Proposal 5:** The application time of the updated cell-specific K\_offset shall be the same for a UE acquiring the new SI via RRC or via SIB acquisition.**Proposal 6**: The application time of the updated K\_offset at cell level needs to pre-defined and different from the first SIB occasion in the modification period. **Proposal 7:** The application time of the recently acquired updated cell-specific K\_offset is determined as the end of the first modification period after the update. **Proposal 8:** In case of imminent expiry of the validity timer, the UE should have a mechanism to indicate so to the gNB such that corrective actions can be taken.**Proposal 9:** Upon validity timer expiry the UE shall halt any scheduled UL transmissions.**Proposal 10:** Upon expiry of the validity timer, the UE shall reacquire NTN SIB and use the RACH procedure for reacquiring the system synchronization.**Proposal 11:** No need to introduce negative values for TACommonDriftVariation. **Proposal 12:** When indicating Epoch time in an explicit manner, the SFN that is indicated will indicate either current SFN or future SFN’s.**Proposal 13:** No wrap-around for explicit SFN indication is allowed, meaning that the maximum indication of Epoch time into the future would be “SFN-1”, meaning 1023 SFNs into the future. |
| [**R1-2203935**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203935.zip) | NEC | **Proposal 1.** The UE shall re-acquire new assistance information before the expiry of the UL validity timer.**Proposal 2.** If a UE has obtained new assistance information prior to the time of the validity timer expiring, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached.**Proposal 3.** The UE suspends the validity timer until the new Epoch time is reached if new NTN assistance information is required before the validity timer expires. |
| [**R1-2203990**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203990.zip) | OPPO | 1. Adopt the proposed TP#1 for 38.213 to clarify Koffset application for TAC.
2. Differentiate downlink/uplink slot for MAC-CE activation/deactivation for downlink configuration.
3. Adopt the proposed TP#3 for 38.213 to clarify C-DAI and T-DAI count for feedback-enabled HARQ processes.
4. During handover, the target cell’s satellite ephemeris, common TA related parameters and the epoch time indication can be provided by the target gNB and then transparently forwarded to UE by the source gNB.
5. When target cell’s epoch time is explicitly provided in handover command, UE follows the target cell’s downlink timing to determine the target cell’s epoch time (i.e. SFN and subframe number).
6. When neighbour cell’s epoch time is explicitly broadcasted for IDLE mode measurement, UE follows the serving cell’s downlink timing to determine the neighbour cell’s epoch time (i.e. SFN and subframe number).
7. If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received.
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| [**R1-2204207**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204207.zip) | Apple | **Proposal 1:** Confirm the working assumption that when TAC () in msg2/msgB is received, UE receives the first adjustment and is updated as , where is the TAC field in msg2/msgB. **Proposal 2:** RAN1 concludes the discussion on the “double correction” issue, with no update of the reference timing calculation formula. **Proposal 3:** If UE re-acquires assistance information before uplink synchronization validity timer expiry but the new epoch time in the assistance information is after uplink synchronization validity timer expiry, UE suspends uplink transmissions until the new epoch time reaches. * UE does not need to re-acquire additional assistance information
* Validity timer restarts at the new epoch time

**Proposal 4:** If epoch time is explicitly indicated in the form of SFN and sub-frame, the UE considers the epoch time is in the frame of the indicated SFN value, which is nearest to the frame where the message is received. **Proposal 5:** Adopt the following text proposal on HARQ-ACK codebook construction for SPS PDSCH.

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| TS 38.2139.1.2 Type-1 HARQ-ACK codebook determination \*\*\* < Unchanged parts are omitted> \*\*\*while Set – SPS PDSCH configuration index: lower indexes correspond to lower RRC indexes of corresponding SPS configurations while Set – slot index while if {a UE is configured to receive SPS PDSCHs providing a transport block for a HARQ process with enabled HARQ-ACK information from slot to slot for SPS PDSCH configuration on serving cell , excluding SPS PDSCHs that are not required to be received in any slot among overlapping SPS PDSCHs, if any according to [6, TS 38.214], or based on a UE capability for a number of PDSCH receptions in a slot according to [6, TS 38.214], or due to overlapping with a set of symbols indicated as uplink by tdd-UL-DL-ConfigurationCommon or by tdd-UL-DL-ConfigurationDedicated where is provided by pdsch-AggregationFactor-r16 in sps-Config or, if pdsch-AggregationFactor-r16 is not included in sps-Config, by pdsch-AggregationFactor in pdsch-config, andHARQ-ACK information for the SPS PDSCH is associated with the PUCCH} = HARQ-ACK information bit for this SPS PDSCH reception ;end if;end while;end while;end while |

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| [**R1-2204345**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204345.zip) | NTT DOCOMO, INC. | **Proposal 1:** Confirm the working assumption made in 107-e meeting: When TAC ( in msg2/msgB is received, UE receives the first adjustment and is updated as: , where is the TAC field in msg2/msgB**Proposal 2:** The issue on combination of open and closed loop TA control is up to the UE implementation to meet the RAN4 gradual timing adjustment requirement. Further discussion is not needed in RAN1.**Proposal 3:** Regarding the issue of validity timer expiry, it is clear enough in current spec., and there is no need to further discuss it in RAN1.**Proposal 4:** Either to modify the value range and bits allocation of TACommonDriftVariation as value range of - 0.60 µs/  … + 0.60 µs/, and bit allocation of 16 bits, or keep the current value range could be supported. If the value range is modified, send LS to RAN2 to inform this modification.**Proposal 5:** Indicated SFN for Epoch time is current SFN or the next upcoming SFN after the frame where the message indicating the Epoch time is received. Send LS to RAN2 to inform this modification. |
| [**R1-2204519**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204519.zip) | LG Electronics | Proposal 1. Confirm the following working assumption:Working assumption:When TAC () in msg2/msgB is received, UE receives the first adjustment and is updated as:* Option 1: .

where, is the TAC field in msg2/msgBProposal 2. The NTN UE shall re-acquire new assistance information before expiry of UL validity timer.* The Epoch time of additional information (e.g., common TA parameters and/or ephemeris information) should be set before expiry of validity timer.
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| [**R1-2204556**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204556.zip) | THALES | **Observation 1.** In case of GEO based NTN, NTACommonDriftVariation can be negative. Therefore, if NTACommonDriftVariation is to be indicated in case of GEO, negative TACommonDriftVariation values shall be supported.**Proposal 1:**Adopt the TP for 3GPP TS 38.213 given in section 2 of this contribution**Proposal 2:**Adopt the following TP for 3GPP TS 38.211 given in section 3 of this contribution**Proposal 3:** On combination of open and closed loop TA control, no further discussion is needed at RAN1. As the framework of gradual timing adjustment requirement is used to alleviate the impact of double-correction of UE uplink timing in NTN (RAN4 reply LS [R1-2203020]).**Proposal 4:** Indicated SFN for Epoch time is current SFN or the next upcoming SFN after the frame where the SIB19-r17 indicating the Epoch time is received.**Proposal 5:*** The UE should re-acquire new assistance information before expiry of UL validity timer.
* If a UE has obtained new serving satellite ephemeris and Common TA related parameters prior to the time of the validity timer expiring and the validity timer expires before new Epoch time is reached, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached. For this, the time interval from the expiration of the validity timer until the new Epoch time must not be larger than the new validity duration. In this case:
	+ The UE suspends the timer during this period such that it does not expire, and restarts the validity timer at the new Epoch time.

Note : UE should always apply new assistance information obtained within uplink sync validity duration.**Proposal 6:** If Proposal 5 is agreed, RAN1 to send an LS to RAN2 to inform RAN2 about the solution agreed in RAN1 to clarify UE behavior when a UE has obtained new serving satellite ephemeris and Common TA related parameters prior to the time of the validity timer expiring and the validity timer expires before the new Epoch time is reached.**Proposal 7:** NTACommonDriftVariation is not indicated in case of GEO based NTN.**Proposal 8:** Confirm the following working assumption made at RAN1#107-e:When TAC () in msg2/msgB is received. UE receives the first adjustment and is updated as:. Where. is the TAC field in msg2/msgB. |
| [**R1-2204660**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204660.zip) | Ericsson | **Observation 1** If the network indicates ephemeris with an Epoch time in the future, the UE can propagate the satellite orbit both backward and forward from this point, and the useful period of the received ephemeris will be significantly longer than with an Epoch time in the past. This benefits both network and UE without significant cost.**Observation 2** The limited range of the SFN (10.24 seconds) forces the network to frequently update the broadcast ephemeris data, which is an unnecessary burden on the network in e.g. GEO where the ephemeris can be valid for a significantly longer time.Observation 3 The common TA parameter TACommonDriftVariation can have negative values down to approximately -2×10-4 µs/s2 for GEO with large inclination angles.Based on the discussion in the previous sections we propose the following:[Proposal 1 Support indication of explicit Epoch time through the SFN of a future radio frame.](#_Toc101796884)[Proposal 2 To extend the range of explicit Epoch time, indicate a few LSBs of the H-SFN in addition to SFN and subframe number.](#_Toc101796885)[Proposal 3 Assistance information with an Epoch time at a future point in time is also valid for a period P before the indicated Epoch time (in addition to a period P after the indicated Epoch time), where P is given by the validity duration parameter.](#_Toc101796886)[Proposal 4 If a UE has obtained new assistance information prior to the time of the validity timer of old assistance information expires, the UE is allowed to maintain its UL synchronization until the new Epoch time is reached, under condition that the validity periods of the old and new assistance information overlap. In this case, the UE applies the new assistance information as soon as it is valid, suspends the validity timer during this period such that it does not expire, and restarts the validity timer at the new Epoch time.](#_Toc101796887)[Proposal 5 Send an LS to RAN2 to ask them take into account the solution above (assuming it is agreed by RAN1). Due to parallel RAN1/RAN2 meetings, the LS should be sent as soon as possible during the RAN1 meeting.](#_Toc101796888)[Proposal 6 For GEO, the common TA parameter TACommonDriftVariation should have a value range of at least (-2×10-4 µs/s2 … 2×10-4 µs/s2) and a granularity of at least 2×10-7 µs/s2.](#_Toc101796889)[Proposal 7 Adopt the following TP for 3GPP TS 38.213:](#_Toc101796890)

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| [--------------------------------- Start of TP for 3GPP TS 38.213 ----------------------------------](#_Toc101796890)**[4.2  Transmission timing adjustments](#_Toc101796890)**[<Unchanged Text Omitted>](#_Toc101796890)[Using higher-layer ephemeris parameters for the serving satellite, if configured, the UE calculates , using serving satellite position and its own position, to pre-compensate the two-way transmission delay on the service link.](#_Toc101796890)[To pre-compensate the two-way transmission delay between the uplink time synchronization reference point and the satellite, is derived by the UE based on ,which can be obtained as:](#_Toc101796890)[where is the Epoch time of the higher-layer parameters](#_Toc101796890) *[TACommon](#_Toc101796890)*[,](#_Toc101796890) *[TACommonDrift](#_Toc101796890)*[, and](#_Toc101796890) *[TACommonDriftVariation.](#_Toc101796890)*[This gives the distance at time between the satellite and the uplink time synchronization reference point divided by the speed of light.](#_Toc101796890)[The uplink time synchronization reference point is the point at which DL and UL are frame aligned with an offset given by .](#_Toc101796890)[---------------------------------- End of TP for 3GPP TS 38.213 ---------------------------------](#_Toc101796890) |

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| [**R1-2204933**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204933.zip) | Mavenir | **Proposal 1:** Add 1 bit for allowing support of negative TACommonDriftVariation values for GEO.**Proposal 2:** The UE shall re-acquire new assistance information before expiry of UL validity timer.**Proposal 3:** If indicated explicitly by a SFN and subframe number the Epoch time t\_epoch is in the future when UE reads the SIB at time t, where t ≤ t\_epoch. |
| [**R1-2204984**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204984.zip) | Qualcomm Incorporated | **Proposal 1:** When TAC ( in msg2/msgB is received, UE receives the first adjustment and is updated as follows: ,.**Proposal 2:** For DCI scheduled PUSCH including CSI on PUSCH and aperiodic SRS and for HARQ-ACK on PUCCH, the Koffset that is valid at the slot of the associated DCI being received is applied. **Proposal 3**: adopt the following TP to Section 9.1 of TS38.213 [4], with the addition in red:

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| For the remaining of this clause, if a UE is provided by *Koffset* in *ServingCellConfigCommon* or by a MAC CE command, reference to a slot for a PUCCH transmission or PUSCH transmission corresponds to a slot for the PUSCH or the PUCCH transmission, and additionally, reference to a slot corresponds to , where is the SCS configuration for the PUCCH transmission or PUSCH transmission, …**Reasons of change:** current description of usage of Koffset does not cover all the cases.**Summary of change:** added a statement to cover a missing case.**Consequence if not approved:** incorrect Type-1 codebook construction when Koffset is configured |

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