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:

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| [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

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| **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 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.  |
| ZTE | Generally fine with the proposal although we think the second bullet is not necessary since the case can be avoided by UE implementation. |
| Panasonic | Our proposal is not correctly captured. We think that UE should not use satellite assistance information *outside* of the indicated validity duration because we expect an uncontrollably large approximation error of at least the common TA value. Our proposal was not to suspend the timer but rather to suspend the transmission. We agree with initial proposal 1. |
| CATT | We think the second bullet is not needed because network should avoid this case happening. |
| Nokia, Nokia Shanghai Bell | This proposal does not address the aspect of a UE potentially losing its UL synchronization at time instants where it is not known to the gNB. Just having a UE dropping off the system without the gNB knowing will cause the gNB to block the UE scheduling. How would the gNB know that the UE has re-acquired the SIB19 (or that it has reached the Epoch time of a newly acquired SIB19 to be accurate)?Further, according to our understanding, the UE should be able to apply any newly acquired information for the time duration of the “validity time” in a symmetrical manner around the Epoch time. That is, the assistance information is also to be seen as valid by the UE for a time duration corresponding to “validity timer” prior to Epoch time. |
| Samsung | OK with the first bullet. Can further discuss the second bullet - we also currently think is unnecessary. |
| OPPO | We are also fine with the first bullet.  |
| QC | We are fine with the first bullet and don’t see the need of the second bullet. |
| Ericsson | We do not support the proposal.We think there is a misunderstanding of the purpose of solution 1 (allowing the UE to use assistance information before the epoch time). It is to increase the total validity period of the serving satellite ephemeris, not the common TA. There is no issue with "backward propagation" of common TA since the accuracy of curve fitting is independent of the choice of epoch time. If e.g. a set of common TA parameters with epoch time tepoch=0 are derived that give a max estimation error e in the interval [0,30s], it is straightforward to derive corresponding common TA parameters with epoch time tepoch=10s that describe exactly the same polynomial and hence give the same max error e in the interval [0,30s].P(t) = a + bt + ct2  = a' + b'(t-10) + c'(t-10)2wherea'=a+10b+100cb'=b+20cc'=cThus, if common TA parameters a,b,c are broadcast at time t=0 with tepoch=0 and validity duration 30s, they are valid in the time interval [0,30s]. If corresponding common TA parameters a',b',c' are broadcast at time t=0 with tepoch=10s and validity duration 20s, they are also valid in the time interval [0,30s]. The estimation error will be the same in both cases.For UE-specific TA, backward and forward propagation from the epoch time will have equal accuracy, and utilizing both will therefore increase the total validity period of the ephemeris information. |
| Sony | We are basically fine with the initial proposal, but if the UE had acquired new assistance information before the validity timer had expired, why would it suspend its uplink transmission there and then? Wouldn’t the UE only suspend UL transmission after the validity timer of the old assistance information had expired? Our proposed modification to the text of the second main bullet is:* **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 from the time of uplink synchronization validity timer expiry until the new epoch time is reached.**

We think it would be useful if the UE could indicate to the network that its validity timer will expire such that it doesn’t end up in the situation where it has to suspend UL transmissions in the first place: If the UE lets the network know that its validity timer is about to expire, the new UL sync information can be delivered in a UE-specific manner before the validity timer expires. |
| NTT DOCOMO | We are fine with the first bullet. |
| Huawei, HiSilicon | For the first sub-bullet, there is no need to reconfirm the RAN2 agreement.For the second sub-bullet, although the new epoch time in the assistance information is after uplink synchronization, UE can know where the new epoch time is upon reception of assistance information and therefore propagation assistance information backward. It is UE’s implementation to keep the UL synchronization.  |
| LG | Agree with Huawei. Regarding the first bullet, it was already agreed in RAN2. Also, for the second bullet, we think it can be handled with UE implementation.  |
| Xiaomi | We are fine with this proposal.We think it also depends on the discussion results of SFN indication, if we agreed that it always indicate a past SFN, the proposal is not needed. |

## Updated proposal and companies views’ collection for 2nd round

CATT: think the second bullet is not needed because network should avoid this case happening. To moderator, it is not clear how the network can avoid this corner case happen. It may be solved by UE implementation but not by the network.

To moderator understanding, the issue raised by Nokia (This proposal does not address the aspect of a UE potentially losing its UL synchronization at time instants where it is not known to the gNB) is another issue that might be or not discussed. In existing spec the UE does not inform the gNB if timeAlignmentTimer expires, at expiry of this timer the UE assumes it is out of sync and may initiate a PRACH procedure. It is not clear why in case of imminent expiry of the validity timer, the UE should have a mechanism to indicate so to the gNB. In NTN, upon validity timer expiry, UE shall suspend uplink transmission and re-acquire SIB19.

Ericsson: proposed that the UE suspends the timer during this period. According to Ericsson backward propagation" of common TA since the accuracy of curve fitting is independent of the choice of epoch time. To moderator understanding, companies may share different view and need time to characterize the period P (backward propagation duration). See for example [**ZTE, R1-2203231]** recopied hereafter.

A reasonable way forward: Overall by implementation UE can avoid the issue discussed in this section and can try to acquire SIB19 on time. UE suspends uplink transmissions till new epoch time 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.

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| **ZTE, R1-2203231:**In RAN1#108e [2], the validity time of common TA and ephemeris was discussed and following two types of definitions are considered.1. The epoch time tepoch is the start of validity duration. The UL synchronization is thought kept only in the duration , where is the validity duration length.
2. The epoch time is the middle point of validity time. The UL synchronization is thought kept in the duration , where is the validity duration length.

For definition (1), the backward propagation from epoch time is not considered so that the epoch time should not be set at far future. For definition (2), the epoch time should be at future to enable enough time for backward propagation.In above two definitions, definition (1) should be adopted if fitting is considered in determination of common TA parameters. In our understanding, the motivation of definition (2) is that the common TA error is assumed to be minimized at epoch time and will increase when a time instant is far from epoch time. From this point of view, backward propagation should have similar validity duration as forward propagation. However, with fitting, the indicated common TA parameters are not exactly equal to the real common TA parameters at epoch time. The residual TA error is not minimized at middle point of validity time and will not monotonously increase when the time instant is far from the middle point. Therefore, there is no benefit to define the epoch time as the middle point of the validity time. For example, consider the case shown in Table 1, the common TA, common TA drift rate, and common TA drift rate variation are obtained by fitting the real common TA curve in [0 s, 30 s] to reduce the residual error (i.e., extend the validity duration). With the obtained common TA parameters, the approximated common TA calculated at UE is evaluated as shown in Figure 1. Table 1 Parameters for evaluation

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| --- | --- |
| Parameter | Value |
| Orbit | LEO-600 |
| Initial satellite position | Above Gateway |
| Time period for common TA fitting | [0, 30] s |
| Fitting method | Least square fitting |

curvecomparisonresidualerror1. Real and approximated common TA (b) Residual error of approximated common TA

Figure Evaluation of common TA fittingFrom the Figure 1, it can be easily found that the fitted common TA parameters are not equal to the real ones at t=0. Therefore, the validity of common TA parameters cannot be guaranteed for backward propagation from t=0. In this case, the definition (1) should be adopted. Of course, one may argue that the epoch time can be set at middle point of fitting time period (i.e., t=15 in above case) to enable the definition (2), where forward and backward propagation can have same validity duration length. However, because of SFN wrap around, the epoch time cannot be set at a time that is 10.24 s far from the reception time. That is, the validity duration for backward propagation is at most 10.24 s. If the total validity time is longer than 20.48 s (e.g., 30 s in above case), setting the epoch time at the middle point will reduce the overall validity duration (e.g., reduced to 25.24s in above case). Overall, the epoch time should be set as the start of validity time period at least with consideration of following aspect:* When curve fitting is adopted to extend validity duration of common TA, the validity of backward propagation cannot be guaranteed.
* The validity duration of backward propagation is limited by SFN wrap around.
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Based on the feedback from many companies, the first bullet is removed as it was already agreed in RAN2.

The proposal is updated as follows:

**Updated Proposal 1-v01:**

* **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 from the time of uplink synchronization validity timer expiry until the new epoch time is reached**

**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:

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| **Companies** | **Comments and Views** |
| Apple | Support |
| Ericsson | We think this proposal has serious drawbacks.The consequence of it (in combination with e.g. solution 2 for epoch time definition in Updated Proposal 2-v01) is that the UE must assume that the epoch time may be up to 10.24 seconds in the future when reading SIB19. The UE must then read new assistance info 10.24 seconds before the validity timer of old assistance info expires, to avoid a potential gap. If it turns out that the new epoch time is the current SFN, the UE will start the new validity timer immediately. In practice, this means that **the assistance information is useful 10.24 seconds shorter than the validity duration signaled by the network, which can be a significant reduction for the short validity durations expected for LEO** (e.g. 20 seconds, but validity duration values down to 5 seconds are supported).Also, if there is a concern that common TA cannot be accurately propagated up to 10.24 s backward in time, then this concern is equally valid during initial access. **Before initial access, the UE (usually) does not have valid assistance information, but acquires SIB19 for the first time. Then if the epoch time is in the future, the UE must suspend its preamble transmission up to 10.24 seconds, which is not acceptable.** For initial access, either the UE must be allowed to use the assistance information prior to the epoch time, or the epoch time must not be set in the future. It can also be noted that it has already been **agreed to define implicit epoch time as the end of the SI window, i.e., in the future. Also in this case, having to suspend preamble transmission until the end of the SI window can lead to unacceptable delays**. We see no reason to have different UE behavior for initial access and connected mode.Regarding [ZTE, R1-2203231], copied above, we think that the epoch time in the example in figure 1 (b) could be set anywhere between 0 s and 10.24 s and we don't see that there would be an issue with any choice in that interval as long as the UE is allowed to use the common TA parameters before the epoch time. |
| MediaTek | Not support. We have same understanding as Ericsson.We do not see a need for UE to suspend uplink transmissions if it has re-acquired SIB19 before uplink synchronization validity timer expiry and new epoch time in the assistance information is after uplink synchronization validity timer expiry. In any case the UE can maintain UL synchronization via implementation. It is not clear how the UE can suspend its uplink transmission without scheduling restrictions.  |
| Panasonic | Support. In our view, to allow UL transmission outside the validity period means UE may transmit un-synchronized transmission, which increases the interference to other UEs. Therefore, permitting it would have serious drawbacks.Figure 1b from ZTE, R1-2203231 (above) shows clearly that the approximation error of the Common TA polynomial increases rapidly outside its validity period. UE should not be allowed to use assistance information in such cases. We also think the UE implementation can do very little since it is in the nature of polynomials that good approximation is only feasible over a finite region, i.e., the validity period. Such case would require further new timer and new performance requirement for the period UE must ensure UL frequency synchronization. Rather, gNB is required to operate SIB19 so as to limit negative effects such as reduction of validity period and access delays.  |
| ZTE | Support.Firstly, in our evaluation, the validity duration of ephemeris is generally longer than the common TA. In [ZTE, R1-2203231], we have shown an example where the maximum common TA error with 30s propagation can be as large as 0.86us even with LS fitting. However, for ephemeris, such error can enable a propagation period of over 100s (simple gravity based propagation) as shown in figure below. Hence, the validity duration is more limited by common TA instead of ephemeris. Only extending the validity duration of ephemeris may not provide much gain.TAerrorexampleMoreover, as we elaborated in [ZTE, R1-2203231], setting the epoch time at the center of whole validity time is not reasonable since backward validity length is limited by SFN wrap around. And it is weird to set the epoch time between 0s and 10.24s of common TA validity duration since the start of the common TA validity duration is not known by UE unless network additionally indicates the backward propagation validity duration. If UE does not know the exact start time of validity duration, the network should conservatively set the interval between epoch time and the start of common TA validity duration to ensure UE can apply the information at any time after UE receives it, which may reduce the overall validity duration.Based on above observations, we think the best method is to set the epoch time at the start of common TA validity duration so that the duration can be clearly defined and fully utilized. And the epoch time should be set just at the time of receiving assistance information or at near future to reduce the delay. In such case, there is no need to additionally support backward propagation. |
| Mavenir | Not support. We have the same concern as raised by MediaTek and Ericsson.  |
| Nokia, Nokia Shanghai Bell | This is not an acceptable solution. As argued earlier, the UE should not disable and re-enable its UL synchronization in a non-transparent way for the gNB. There are several aspects to this:The assistance information is still valid prior to the Epoch time – the Epoch time is simply indicating the exact time by which the assistance information is seen to be valid for (t=0). Since the assistance information is symmetrical around the Epoch time, the first condition is basically invalid.If UE disables its UL synchronization, the gNB will not receive any UL communication from the UE, and assumes that it is out of coverage (RLF-like situation), and would hence not schedule the UE considering that it also takes quite some time for the gNB to discover the missing response from the UE (at least the RTT). This approach will not resolve the problem of the UE disappearing at random, but it will ensure that the UE will have a safe return to the network.Our starting point here would be that in case a UE loses its UL synchronization it should go through a well-defined procedure to let itself be known to the gNB (whether it is through RACH procedure, RLF procedure or similar procedure is indifferent for us). |
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# [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 EpochTime is 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.  |
| Moderator | The Initial Proposal 2 is modified to clarify what is indicated, as highlighted by MediaTek |
| MediaTek2 | We revised our comments based on modified proposal from moderator. 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. The “**nearest**” would allow to have a maximum of 5.12 seconds from the epoch time and when the UE receives the explicit indication of the epoch time. On the note, it is not clear how the “**nearest to the frame where the message is received**” and the “**network can set the epoch time at near future**” can be determined. There may be cases where the “nearest” is in the past. |
| ZTE | We support the proposal |
| Panasonic  | We are aware that “past” epoch time implies an apriori reduction of the validity duration. However, the benefit is that UE can always immediately apply satellite assistance information upon reception. Also, network operation can ensure that the reduction of the validity period is kept to a minimum. As a compromise we can agree to Initial Proposal 2 and the “nearest epoch time” option. |
| CATT | We support this proposal. |
| Nokia, Nokia Shanghai Bell | We still fail to see any justification for allowing the option to effectively discard more than 50% of the available information. If the Epoch time is allowed to be in the past, the information is already outdated and will deteriorate as time progresses. If Epoch is always into the future, it is ensured that the maximum information content is allowed to be utilized by the UE, and the UE may even read SIB19 fewer times, which is in contrast to indicating Epoch time in the past.It should be noted that it is still possible to apply the assistance information prior to the Epoch time. |
| Samsung | OK with the updated proposal. |
| OPPO | Fine with the proposal |
| QC | We think we should separate the issue for serving cell and other cells. For the serving cell, solution 1 is preferred. For a cell other than the serving cell, solution 2 can be considered. |
| Ericsson | We prefer "solution 2" for reasons explained by Nokia above.We do not understand the motivation behind allowing epoch time to be set in the future (up to 5.12 seconds for "solution 1" and 10.24 seconds for "solution 2"), but not allowing the UE to use the assistance information before the epoch time (Initial Proposal 1). This would force the UE to acquire new assistance information (SIB19) 5.12 or 10.24 seconds prior to the expiry of the validity timer, to make sure that the new epoch time is within the validity time of the current assistance information. The solutions to Issue#1 and Issue#2 should be coordinated. |
| Lockheed Martin | This is OK, though we agree with Nokia’s argument in principle. |
| NTT DOCOMO | OK with the proposal. |
| Huawei, HiSilicon | Support. Our understanding is that the NCC will send the satellite ephemeris to the gNB and gNB needs to derive the assistant information at the Epoch time. The UE also needs to make propagations in order to make use of assistant information. For Option 2, as analyzed in our contribution, taking t\_epoch = SFN 1023 and t = SFN 0 as an example, the network needs to derive the ephemeris at t\_epoch SFN 1023 based on the current ephemeris information. Then, when UE receives the assistance information and t\_epoch, at t, if the validity timer expires, the UE may need to propagate from SFN 1023 back to SFN 0. The derivation duration is long at both network and UE side, and the errors coming from both sides can be large.  |
| LG | We generally agree with initial proposal 2 for reusing the legacy approach for SIB9, but we don’t think the Note is necessary. |
| Xiaomi | We prefer Option 2, because in option 1 the gNB cannot indicate an epoch time more than 5.12s in advance.We can accept Option 1 if most of the companies prefer option 1. |
| Thales  | Support |

## Updated proposal and companies views’ collection for 2nd round

Based on the views expressed during first round, several companies are supportive of Initial Proposal 2. But still the proposal is not acceptable to many companies.

Regarding Nokia and Ericsson’s comments: To moderator understanding, if this proposal is agreed, the network can always set the epoch time to be in the near future to avoid the drawbacks when the epoch time is set in the past and to fully utilize the validity duration.

Given the current situation, it is better to collect companies views on both solutions, hopefully this may help us to understand each other and give us the best chance at reaching consensus the reasonable way forward.

**Updated Proposal 2- v01:**

**Companies are invited to comment on both solutions below- Please elaborate.**

**Solution 1:**

**If EpochTime is 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.**

**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.**

Companies are encouraged to provide views within the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Companies** | **First preference** | **Second preference** | **Unacceptable solution(s)** |
| Apple | Solution 1 | Solution 2 (This solution may more likely lead to issue #1, since the indicated epoch time has a larger possibility to be after the expiry of validity timer) |  |
| Ericsson | Solution 2  | Solution 1 |  |
| MediaTek | Solution 2 (if Solution 1 cannot be clarified) |  | The wording is solution 1 is not clear. How can the frame (with epoch time SFN and subframe) be the nearest to the frame where SIB19 is received if epoch time is always at near future. Say epoch time SFN=1023 and UE receives SIB19 at frame SFN=2. Should the nearest frame (with epoch time) be in future at SFN=1023 or in the past at SFN=1023?  |
| Panasonic | Solution 1 | Solution 2 | In our understanding solution 1 is clear. “Nearest SFN” chooses SFN based on proximity in time. Solution 2 is less clear because it lacks criteria how to decide between current SFN and next upcoming SFN. The intention of solution 2 seems to be that epoch time is chosen as the closest SFN in the future. |
| ZTE | Solution 1 (As we analyzed in Issue#1, epoch time should be set at the time of receiving assistance information or near future. If reduction of delay is important in certain scenarios, setting epoch time at past is also possible with this solution.) | Solution 2 (We do not see clear benefits to set epoch time at far future) |  |
| Mavenir | Solution 1 | Solution 2 |  |
| Nokia, Nokia Shanghai Bell | Solution 2 |  | Solution 1. It will not be acceptable to introduce a solution which will effectively allow to throw away more then 50% of the available information content in the assistance information. |

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

## Companies’ contributions summary

|  |  |
| --- | --- |
| **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. |
| ZTE | We are fine with the proposal. |
| Panasonic | Not indicating NTACommonDriftVariation equals setting it to zero, while there seems to be a need to have it, also for GEO. Rather than that, the indication of NTACommonDriftVariation in case of GEO should be up to network implementation. At this stage it seems reasonable to allow for negative values. We prefer MediaTek’s proposal of adjusting the granularity of NTACommonDriftVariation to account for negative values without increasing overhead. |
| CATT | We support this proposal. |
| Skylo | Not in support of Proposal 03 above. Based on our simulations, NTACommonDriftVariation with the granularity and range proposed below is required to support prediction time of 900 sec for GEO. * TACommonDriftVariation with granularity 2 \* 1e-7 us/s^2 and range +/-3.27 ns/s^2, bits allocation 15 bits

In the absence ofNTACommonDriftVariation,the second-degree term in the polynomial approximation is eliminated entirely, leaving only a linear equation to model the change in TA over time. The following table shows the Common TA prediction error due to TAcommonDriftVariation quantization alone. Different columns in the table represent different uplink synchronization validity duration ( ul-SyncValidityDuration). *Max Common TA prediction error due to TAcommonDriftVariation quantization for GEO:*

|  |  |  |  |
| --- | --- | --- | --- |
|  |  5 min | 10 min  | 15 min  |
| Typical satellite scenario (Existing satellite data used) | 0.3 μs | 1.3  μs | 3.0  μs |
| Worse satellite case scenario(Simulated data used for satellite) | 0.9  μs | 3.6  μs | 8.1  μs |

Above table indicates that the validity time has to be significantly less than 900 sec, if we target TA common prediction accuracy of .1 usec.In summary, we support MTK’s proposal with following range and granularity for GEO. * 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

A UE can determine the satellite type by using the satellite ephemeris information available in the NTN-SIB. No change in the number of bits required. |
| Nokia, Nokia Shanghai Bell | We do not support this proposal. We prefer to have a unified signaling format that is agnostic to the deployment scenario. If needed, the gNB can set the value of *NTACommonDriftVariation* to 0. As shown by Thales contribution there is no need for negative values for the *TACommonDriftVariation*. |
| Samsung | Agree with comments from Panasonic and Nokia. There is no necessity for the proposal.  |
| QC | We are fie with either no agreement or supporting negative values. |
| Inmarsat | We cannot support the moderator proposal. GEO/GSO orbits for communication satellites are never perfectly stationary and it must be possible to maintain a longer validity than a few hundred seconds, therefore negative value for TACommonDriftVariation is required and NTACommonDriftVariation must be indicated.We share views with MTK, Panasonic and Skylo. |
| Ericsson | We do not support this proposal.According to our simulations in R1-2204660, validity duration of common TA is limited to ~300 seconds if NTACommonDriftVariation is not used for GEO (red curve below). With negative NTACommonDriftVariation, validity duration exceeding ~900 seconds can be supported.Chart  Description automatically generated |
| Lockheed Martin | We do not support the proposal. If drift variation is not accounted for in GEO scenarios, UE-calculated common TA cannot be valid for a duration on the order of 900 seconds. |
| NTT DOCOMO | We understand the Moderator’s view and we prefer not to have a proposal.  |
| Huawei, HiSilicon | Fine |
| LG | It is unnecessary to define **NTACommonDriftVariation** as unavailable in GEO. Moreover, if adding 1 bit is supported for **NTACommonDriftVariation**, it is not desirable to use the additional 1 bit as an indicator of positive/negative values, and it is preferable to define a new value range including negative values with a total of 16 bits (adding 1 bit to the existing 15 bits). |

## Updated proposal and companies views’ collection for 2nd round

The views on issue#3 are quite diverse.

Many companies prefer MediaTek’ s proposal: MediaTek , Lenovo, Panasonic, Skylo, Inmarsat, Ericsson, LG

Companies not supportive of the proposal: Nokia Shanghai Bell (prefer to have a unified signaling format that is agnostic to the deployment scenario), Samsung (proposal is not needed), QC (either no agreement or supporting negative values.), Lockheed Martin, NTT DOCOMO (prefer to not have a proposal)

Companies supportive or fine with the proposal: ZTE, CATT, Huawei, HiSilicon,

Clearly, the majority is not supportive of Initial Proposal 03: many companies prefer the proposal made by MediaTek. Some companies prefer to not have this agreement.

**Moderator’s view**: negative TACommonDriftVariation can be supported. But, the main question; how it can be supported?

To moderator understanding to support negative TACommonDriftVariation values, adding one extra bit would not resolve the issue. In fact, a new granularity and range (as proposed by MediaTek) should be used specifically for GEO to ensure common TA estimation during longer duration with sufficient accuracy. But if this approach is adopted the UE shall differentiate between GEO and LEO deployment. Otherwise, how the UE interprets the indicated bits? Which granularity to be used? If a RAT-type flag is not indicated it is not clear how to select the suitable granularity (the one for GEO? or LEO?) to derive NTACommonDriftVariation.

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.

As there is no clear majority pointing to one way or the other, let’s discuss the different options of TACommonDriftVariation indication if negative values are supported:

Updated Proposal 03- v01:

**Companies are invited to comment on the following options:**

**Option 1:**

**NTACommonDriftVariation is indicated in case of GEO based NTN with 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**

**FFS: How the UE differentiates between GEO and LEO deployment scenario to use the relevant granularity.**

**Option 2:**

**Add 1 bit for supporting negative TACommonDriftVariation values for GEO**

**Option 3:**

**Other**

Companies are encouraged to provide views within the following table – Please elaborate:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| Apple | If negative value of NTACommonDriftVariation is applied to GEO, then we prefer the direction of Option 1 to avoid the payload difference from LEO. However, the detailed value range and granularity of TACommonDrift and TACommonDriftVariation need to be further examined. For example, TACommonDrift has granularity of 0.2\*1e-3 us/s.  |
| Ericsson | We support Option 1 in principle. To keep unified signaling for GEO and non-GEO, a unified range for both GEO and LEO could be used. E.g for TACommonDriftVariation,Value range = [ (-16384…16383)\*2e-7 (17…32784)\*2e-4 ] (16 bits) |
| MediaTek | Option 1. Option 2 has an issue with granularity which results in quantization loss as observed with simulations from several companies.Option 1 has the advantage of not increasing signalling overhead. UE implementation can determine the orbit from the ephemeris on SIB19 in straightforward way. A unified range as suggested by Ericsson could also be considered. |
| Panasonic | Support for Option 1. |
| ZTE | We prefer unified design, i.e., adopt same value range and granularity for both LEO and GEO. As moderator mentioned, unified design is considered so far. We should not consider the issue of differentiating different orbits in maintenance phase. To resolve the granularity issue, we can allocate more bits for common TA parameters to allow finer granularity, e.g., as suggested by Ericsson. |
| Mavenir | We support Option 1 in principle. To keep same signaling for GEO and non-GEO.  |
| Nokia, Nokia Shanghai Bell | Option 3: Signaling framework for assistance information is already in place, and solutions 1 and 2 are simply optimizations, which are not needed at this stage (they are changing/adding functionality). |

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

## Companies’ contributions summary

|  |  |
| --- | --- |
| **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.  |
| ZTE | Fine with the proposal. |
| Panasonic | Although we think Initial Proposal 04 is reasonable for reducing UE complexity, we are not sure whether it is feasible from a network perspective because neighbour’s cell may be from different gNB. We agree to the Initial Proposal "from a RAN1 perspective". It means RAN2 can discuss it if necessary. Note that in our understanding a similar discussion is held in [AT118-e][107][NTN] System information (Huawei). |
| CATT | In order to make it clear, the main bullet can be modified as the follows:“If satellite ephemeris and common TA parameters of neighbour’s cell are indicated to UE via RRC dedicated signalling: ”For SIB signalling, the reference timing is different. Neighbouring cell broadcasting information should be linked to neighbouring cell timing. |
| Nokia, Nokia Shanghai Bell | We do not support this proposal. In general, the information from a potential target cell should be with reference to the target cell, as the source gNB should not be modifying IEs that are provided from a target cell (at least according to our understanding, such IEs are provided as containers that are transparent to the source cell, and hence the source cell should not make any modifications). |
| Samsung | Same opinion as Panasonic – this can be tagged as “from a RAN1 perspective” in an LS to RAN2.  |
| OPPO | We support moderator’s proposal. We think that it is important to care for UE implementation. For RRM, if it requires the UE to repeat the same processing to derive the epoch time for each of the neighboring cells, it becomes not practical.  |
| QC | The feasibility of the proposal is questionable. |
| Ericsson | This is ok for neighbor cell measurements to avoid that the UE must read MIB in neighbor cells to interpret the assistance information.For handover, the assistance information will be used for UL synchronization in the target cell and therefore must be highly accurate. Therefore, it should be provided by the target cell, using epoch time based on timing of the target cell, and transparently forwarded by the source cell to the UE.Clarify if **Initial Proposal 04** only covers neighbor cell measurements or also handover. |
| Sony | Support this proposal. |
| NTT DOCOMO | OK with this proposal. |
| Huawei, HiSilicon | Support. |
| LG | We prefer that the epoch time and related reference point of assistance information for neighbor cell is based on neighbor cell’s timing. Moreover, validity duration of assistance information for neighbor cell can be provided independently. |
| Xiaomi | Support |
| Thales | Support |

## Updated proposal and companies views’ collection for 2nd round

Companies provided their views on issue#4.

13 companies support the proposal: Lenovo, Apple, ZTE, Panasonic (not sure whether it is feasible from a network perspective because neighbour’s cell may be from different gNB), CATT (with modification), Samsung, OPPO, Ericsson (neighbor cell measurements), Sony, NTT DOCOMO, Huawei, HiSilicon, Xiaomi, Thales.

4 companies do not support: Nokia, Nokia Shanghai Bell, QC (The feasibility of the proposal is questionable), LG. MediaTek (not needed).

Just for info, the following proposal (13) is being discussed at RAN2 : **Proposal 13: During HO, the target cell’s epoch time (i.e. SFN and subframe number) is based on target cells’ timing**. It is not yet agreed but a large majority at RAN2 is supportive of Proposal 13.

The intention of Initial Proposal 04 is to resolve the issue#4 from RAN1 perspective. But it seems that RAN1 and RAN2 do not share the same view on this topic.

To move forward, Is it acceptable from RAN1 perspective to adopt RAN2 approach? and thereby modify the Initial Proposal 04 as follow:

Updated Proposal 04-v01:

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

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

Companies are encouraged to provide views within the following table:

|  |  |
| --- | --- |
| **Companies** | **Comments and Views** |
| Apple | If RAN2 is actively discussing this issue, RAN1 should avoid the duplicated discussions when possible. We may simply wait for RAN2’s decision.  |
| Ericsson | Is it a correct understanding that the proposal now only refers to target cells, i.e. for handover, not neighbour cells for measurements? Then we are fine with the proposal. But in that case it should also be clarified how epoch time is defined in case of neighbour cell measurements. For neighbour cells, serving cell timing should be used to define epoch time since otherwise the UE has to acquire the timing of neighbour cells (reading MIB) before measuring. |
| MediaTek | We have same view as Apple. To our understanding, the requirements for cell measurements are different from UL synchronization in serving cell. This may also be a RAN4 discussion.  |
| Panasonic | Wait for RAN2.Ericsson raises a fair point. It is not quite clear if handover and/or neighbor cell measurement is intended here. In our understanding, reading MIB is supported for handover. But for neighbor cell measurement, reading MIB might only be necessary for FR2 but not for FR1. We should discuss this after the RAN2 agreement. |
| ZTE | Fine to wait RAN2 discussion |
| Nokia, Nokia Shanghai Bell | We are supportive of this proposal. As already indicated, a source gNB should not and would not be able to modify the information content coming from the target gNB (it is carried in a transparent container which is dedicated for the IE). If inter-satellite mobility is considered, the gNB would know this and most likely have the same time reference for system timing and Epoch time. |

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

## Companies’ contributions summary

|  |  |
| --- | --- |
| **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.  |
| ZTE | Fine with the proposal |
| Panasonic | We agree. |
| CATT | OK |
| Nokia, Nokia Shanghai Bell | No need for this change. The range has already been agreed with the given granularity. This is an unnecessary optimization which will only provide a wider range (which is not used anyway). |
| Samsung | OK |
| QC | OK |
| Inmarsat | We are ok with the proposal. |
| Ericsson | OK |
| Lockheed Martin | Fine with the proposal |
| NTT DOCOMO | OK |
| LG | We are not sure these modifications are necessary. If the intention of this proposal is to fill all available values for the allocated bits, why not modify the TAcommon? (i.e., 226 = 67108864, but current value range is 0…66485757) |

## Updated proposal and companies views’ collection for 2nd round

Based on the views expressed during 1st round, the majority is Ok to update the ranges for TACommonDrift and TACommonDriftVariation.

[Nokia, Nokia Shanghai Bell, LG, Apple (on TACommonDriftVariation)] do not see the need for such change.

To the Moderator, these value ranges can be updated as this is acceptable to the majority. The proposal is updated as follows:

**Updated Proposal 05-v01:**

**Adopt new range for TACommonDrift - 262144… + 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** |
| Apple | We are fine with the correction on the range for TACommonDrift. However, we still do not see the motivation of updating the range of TACommonDriftVariation.  |
| Ericsson | Support (partly depending on Issue#3). |
| MediaTek | Support the moderator proposal (It may depend on how issue#3 is concluded). This is a straightforward correction matching bit allocation, range and granularity with no impact on signalling overhead.  |
| Panasonic | Support, but also depends on Issue #3. |
| ZTE | Depends on the result of issue#3 |
| Nokia, Nokia Shanghai Bell | Do not support. We have already had discussion on these value ranges, and we do not see a need for introducing some signaling states that defines signaling values that will never be used. |

# [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 |
| ZTE | Support |
| Panasonic | We agree. |
| CATT | Support |
| Nokia, Nokia Shanghai Bell | OK |
| Samsung | OK |
| Inmarsat | OK |
| Ericsson | OK |
| NTT DOCOMO | OK |
| Huawei, HiSilicon | Fine with the main bullet. Note sure about the need of the sub-bullet.  |
| LG | Generally, for orbital element format, the reference plane of satellite orbiting the Earth is defined as the equatorial plane of the Earth, and the reference direction in the solar system is defined as the vernal equinox. However, if the intention of this proposal is to define it clearly, we are fine with this proposal. |
| Thales | Ok |

## Updated proposal and companies views’ collection for 2nd round

The Initial Proposal 06 seems acceptable to all companies provided inputs to first round of email discussions.

Updated Proposal 06- v01 will be further discussed via RAN1 reflector for mail endorsement.

Updated Proposal 06 – v01:

**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)**

# [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.  |
| MediaTek | Support moderator proposal. The issue is about clarification on MAC-CE Activation/Deactivation. Our understanding is that at the UE, the UL slot n corresponds to the DL slot n with the TA applied. UE transmits PUCCH with HARQ ACK of PDSCH with the MAC CE command on a DL configuration at uplink slot n. The eNB receives it at eNB uplink n. Then after processing delay of , the eNB schedules new DL transmission according to the MAC CE on a DL configuration. The UE can then receive the PDSCH according to the MAC CE on a DL configuration from **the first downlink slot that is after downlink slot**. |
| ZTE | Since the configuration is for downlink, downlink slot is by default. Hence, we think the update is not necessary. But if majority view is to further clarify it, we are also fine. |
| Panasonic  | We agree. |
| CATT | Support this proposal |
| Nokia, Nokia Shanghai Bell | OK |
| Samsung | Agree with Apple. The agreement is already clear.  |
| OPPO | We support the proposal |
| QC | We don’t support the proposal. Original agreement is clear and consistent with existing spec. As pointed by Apple, slot is an UL slot but assumed to be aligned with DL slot, not the actual transmit time. |
| Ericsson | We support the proposal |
| Lockheed Martin | We agree that if the “first slot that is after slot…” is in reference to downlink, enhancement by Kmac is needed. |
| NTT DOCOMO | We support |
| Huawei, HiSilicon | Support |
| LG | Fine with changes, but do we really need to update the previous agreement? It is preferred to directly discuss the text proposal regarding this issue.  |
| Thales | Support |

## Updated proposal and companies views’ collection for 2nd round

11 Companies are supportive of the proposal: Lenovo, , MediaTek, , Panasonic, CATT, Nokia, Nokia Shanghai Bell, , OPPO, Ericsson, Lockheed Martin, NTT DOCOMO, Huawei, HiSilicon, LG (prefer to discuss the TP), Thales

4 Companies are not supportive of the proposal and argue that original agreement is clear: Apple, ZTE (open to support it), Samsung, QC.

The majority is ok to Modify the agreement. Based on companies comments it can be seen that some clarification maybe needed.

Companies are invited to read each other’s comments provided during the first round.

Updated Proposal 7-v01 will be further discussed during the second round. The update proposal is made as follows:

Updated Proposal 7-v01:

**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** |
| Apple | We still do not think the modification is needed. We think “” is in terms of uplink slot, as n is uplink slot and µ is the SCS configuration for the PUCCH. The first addition of “downlink” is also not needed since it is the MAC CE command for downlink configuration.  |
| Ericsson | Support |
| MediaTek | Support moderator proposal. We have same understanding as mentioned by ZTE in previous round that since the configuration is for downlink, downlink slot is by default. Apple and QC comments seem correct, but it is not clear from agreement that slot is an UL slot but assumed to be aligned with DL slot, not the actual transmit time. It would be helpful to clarify to avoid potential ambiguity. |
| Panasonic | Support |
| ZTE | Fine with the proposal |
| Nokia, Nokia Shanghai Bell | We would be OK with this. |

#  [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.  |
| ZTE | Fine with the proposal |
| Panasonic | We support the initial proposal 8. |
| CATT | OK |
| Nokia, Nokia Shanghai Bell | OK |
| Samsung | We agree with Lenovo. If Koffset is applied at the slot of the DCI reception, what happens with previously scheduled transmissions that are after the slot of the DCI reception? The certain way to avoid any problems would be to apply Koffset to the transmission triggered by the DCI, not before that transmission. |
| OPPO | Is this proposal equivalent to saying: UE should use the K offset value at the moment of DCI reception? If so, we are fine with this proposal.  |
| QC | Answer to Lenovo, gNB does not necessarily know the actual transmit time. OPPO’s understanding is correct. |
| Ericsson | We support the proposal |
| Lockheed Martin | This is OK |
| NTT DOCOMO | We support |
| Huawei, HiSilicon | Support. |
| LG  | For the initial proposal, one clarification point can be how to determine valid K\_offset. Is it correct understanding that new valid K\_offset is applied after reception of SIB or MAC-CE?  |

## Updated proposal and companies views’ collection for 2nd round

The majority is supportive of Initial Proposal 8.

Updated Proposal 08- v01 will be further discussed via RAN1 reflector for mail endorsement by the first checkpoint.

Updated Proposal 8 – v01:

**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.**

#  [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.  |
| Panasonic | Agreed. |
| CATT | OK |
| Nokia, Nokia Shanghai Bell | OK |
| Samsung | OK |
| OPPO | Agree |
| QC | OK |
| Ericsson | We support the proposal |
| Sony | Support the proposed TP. |
| Lockheed Martin | TP is OK |
| NTT DOCOMO | We support |
| Huawei, HiSilicon | Support  |
| LG | For clarification, the reference of and parameter name of should be add as follows: [4, TS 38.211] is derived by the UE based on one-way propagation delay ,which can be obtained as: |
| Thales | Support |

## Updated proposal and companies views’ collection for 2nd round

Based on first round of email discussions, all companies provided views are supportive of Proposal 09. [LG] proposed a slight modification, highlighted in blue in Updated Proposal 09- v01.

Updated Proposal 09- v01 will be further discussed via RAN1 reflector for mail endorsement.

Updated Proposal 09- v01:

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

**• Reason for change**

* **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.**

**• Summary of change**

* **- Adding the formula of agreed in RAN1#107-e**

**• Consequences if not approved**

* **Incomplete support for NTN operation in NR.**

|  |
| --- |
| --------------------------------- 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, [4, TS 38.211] is derived by the UE based on one-way propagation delay ,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 --------------------------------- |

#  [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. |
| MediaTek | The TPs are not needed. To our understanding the “number of  symbols” does not depend on Koffset |
| Panasonic | Agreed. |
| CATT | This modification is needed.  |
| Nokia, Nokia Shanghai Bell | In general OK with the intent of the proposals above. |
| Samsung | The TP is not needed. Same opinion as MediaTek. This is for the latest time where the UE can apply a TPC command – Koffset is not relevant. |
| QC | Agree with the proposal. In addition, similar changes are needed for periodic and semi-persistent SRS. |
| NTT DOCOMO | We support |
| LG | Fine with changes.  |
| Thales | Support |

## Updated proposal and companies views’ collection for 2nd round

10 companies provided feedback on Initial Proposal 10.

8 companies are supportive: Apple, , Panasonic, CATT, Nokia, Nokia Shanghai Bell, , QC, NTT DOCOMO, LG, Thales

The TPs are not needed according to 2 companies: MediaTek, Samsung.

Updated Proposal 10- v01 will be further discussed via RAN1 reflector for mail endorsement.

Updated Proposal 10-v01:

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

* **Reason for change**
* **In the R1-2202984 CR 38.213, timing relationship in the uplink Power control on PUSCH and PUCCH should be considered in NTN specific scenario. But based on latest specification CR, 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.**
* **Summary of change**
* **Timing relationship in the uplink Power control on PUSCH and PUCCH is considered in NTN specific scenario**
* **Consequences if not approved**
* **Incomplete support for NTN operation in NR.**

**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 \*\*\* |

# [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.  |
| ZTE | We think the update is not necessary. W.r.t the “uplink slot n”, it can be implicitly known as “uplink” by observing that PUCCH is transmitted. W.r.t “first downlink slot that is after downlink slot”, downlink can be implicitly known since it is DL configuration. But if majority view is to further clarify it, we are also fine. |
| Panasonic | We agree with this clarification. |
| CATT | It seems unnecessary.  |
| Nokia, Nokia Shanghai Bell | Agree with Lenovo – this does not seem justified. |
| Samsung | The TP is not needed for the reason explained by Lenovo. |
| OPPO | We agree with the proposal. The clarification can avoid double interpretation of the slot . This is important for the engineers to understand the specification.  |
| QC | The TP is not needed. If we do this, many places in the existing spec need to be changed. |
| NTT DOCOMO | We are fine with the clarification. |
| Huawei, HiSilicon | Fine |
| LG | Fine with changes.  |
| Thales | Fine |

## Updated proposal and companies views’ collection for 2nd round

Based on first round of email discussions, the views are diverse:

6 Companies supportive/ or fine with Initial Proposal 11: **Panasonic, OPPO, NTT DOCOMO, Huawei, HiSilicon, LG, Thales.**

7 companies share the view that the TP is not needed/justified: **Lenovo, Apple, ZTE, CATT, Nokia, Nokia Shanghai Bell, Samsung, Qualcomm.**

There is no clear majority pointing to one way or the other. Also, it seems that some companies are ok to made the change/clarification on MAC-CE activation/deactivation as discussed under issue#7(Proposal 7) but think TP is not needed.

According to [OPPO] this clarification is important for the engineers to understand the specification. But as mentioned by [QC] If we do this, many places in the existing spec need to be changed.

As for Issue#7, let’s further discuss during the second round, hopefully the group can converge before the end of the meeting.

Updated Proposal 11-v01:

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

* **Reason for change**
* **In NTN, It might be understood for TCI states activation, UE would transmit HARQ-ACK in uplink slot *n* and apply the MAC-CE from the first downlink slot that is after downlink slot . For SP SRS activation, UE would transmit HARQ-ACK in uplink slot *n* and apply the MAC-CE from the first uplink slot that is after uplink slot. But the spec does not differentiate whether a downlink slot or an uplink slot should be assumed, the same descriptions apply for both downlink configuration and uplink configuration, and it 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.**
* **Summary of change**
* **To clarify this issue, it is proposed to differentiate downlink/uplink slot for MAC-CE activation/deactivation for downlink configuration.**
* **Consequences if not approved**
* **Ambiguity in spec interpretation.**

|  |
| --- |
| -------------------- 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** |
| Apple | We still think the modification is not needed. 1. PUCCH transmission is by default in uplink slot. First addition is not needed.2. TCI state update is for downlink by default. Second addition is not needed.3. slot is counted in uplink slot since “n” is in uplink slot and ** is the SCS configuration for the PUCCH. Third addition does not seem correct.  |
| ZTE | W.r.t the “uplink slot n”, we still think “uplink” is not needed since PUCCH is clearly by default transmitted in uplink slot.For the later two additions, we still think current spec is clear enough since TCI state update is downlink configuration. But if majority prefer to capture them, we are fine. |
| Nokia, Nokia Shanghai Bell | As already mentioned by a number of companies in the first round, it is a bit obvious that “transmit a PUCCH with HARQ-ACK information in slot *n*” is relating to uplink slot *n*. UE cannot transmit any “physical **uplink** control channel” in downlink slots. In a similar way, PDSCH carrying the activation command (“physical **downlink** shared channel”).So – no need to make this clarification. |

# 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:

|  |
| --- |
| --------------------------------- 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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