**3GPP TSG Meeting #R1-220XXXX**

**Toulouse, France, August 22nd – 26th, 2022**

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| *CR-Form-v12.2* |
| **DRAFT CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | CR on UE pre-compensation in segment |
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| ***Source to WG:*** | Moderator (MediaTek) |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | LTE\_NBIOT\_eMTC\_NTN-Core |  | ***Date:*** | 2022-08-25 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Clarify transmission timing adjustments when UE performs segmented pre-compensation for PUSCH/PUCCH/PRACH for eMTC and for NPUSCH/NPRACH |
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| ***Summary of change:*** | 1. For a BL/CE UE communicating over NTN, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of time units, where the quantity is provided by system information, as specified in 3GPP TS 36.331.

1. For a NB-IoT UE communicating over NTN, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of time units, where the quantity is provided by system information, as specified in 3GPP TS 36.331.

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| ***Consequences if not approved:*** | Incomplete specification to support UE-pre-compensation in NSGO/GSO for eMTC and support UE pre-compensation in NGSO for NB-IoT. |
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| ***Clauses affected:*** | 4.2.3, 16.1.2 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

4.2.3 Transmission timing adjustments

<Unchanged parts are omitted>

For a BL/CE UE in a NTN serving cell, using serving satellite higher-layer ephemeris parameters, if configured, the BL/CE UE determines $N\_{TA,adj}^{UE}$ (defined in [3]) using the 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 serving satellite, the BL/CE UE determines $N\_{TA,adj}^{common} $(defined in [3]) based on one-way propagation delay $Delay\_{common}\left(t\right)$ which can be obtained as:

$$Delay\_{common}\left(t\right)=\frac{1}{2}\left[N\_{TA}^{common}+N\_{TA}^{commonDrift}×\left(t-t\_{epoch}\right)+N\_{TA}^{commonDriftVariation}×\left(t-t\_{epoch}\right)^{2} \right]$$

where $N\_{TA}^{common}$, $N\_{TA}^{commonDrift}$, and $N\_{TA}^{commonDriftVariation}$ are given by the higher layer parameters *nta-Common*, *nta-CommonDrift*, and *nta-CommonDriftVariation* respectively, and $t\_{epoch}$ is the epoch time given by the higher layer parameter *epochTime*. $Delay\_{common}(t)$ provides a distance at time $t$ between the serving satellite and the uplink time synchronization reference point divided by the speed of light. The uplink time synchronization reference point is the point where DL and UL are frame aligned with an offset given by $N\_{TA,offset}$.

For a BL/CE UE communicating over NTN, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of time units, where the quantity is provided by system information, as specified in 3GPP TS 36.331.

<Unchanged parts are omitted>

16.1.2 Timing synchronization

Upon reception of a timing advance command, the UE shall adjust uplink transmission timing for NPUSCH, and SR if configured with higher layer parameter *sr-WithoutHARQ-ACK-Config*, based on the received timing advance command.

The timing advance command indicates the change of the uplink timing relative to the current uplink timing as multiples of 16. The start timing of the random access preamble is specified in [3].

In case of random access response, an 11-bit timing advance command [8], *TA*, indicates *NTA* values by index values of *TA* = 0, 1, 2, ..., 1536, where an amount of the time alignment is given by *NTA* = *TA* ×16. *NTA* is defined in [3].

In other cases, a 6-bit timing advance command [8] or the Timing advance adjustment field in DCI format N0 if present [4], *TA*, indicates adjustment of the current *NTA* value, *NTA,old*, to the new *NTA* value, *NTA,new*, by index values of *TA* = 0, 1, 2,..., 63, where *NTA,new* = *NTA,old* + (*TA* −31)×16. Here, adjustment of *NTA* value by a positive or a negative amount indicates advancing or delaying the uplink transmission timing by a given amount respectively.

For a timing advance command reception ending in DL subframe *n*, the corresponding adjustment of the uplink transmission timing shall apply from the first available NB-IoT uplink slot following the end of *n+12* DL subframe and the first available NB-IoT uplink slot is the first slot of a NPUSCH transmission*.* When the UE's uplink NPUSCH transmissions in NB-IoT uplink slot *n* and NB-IoT uplink slot *n*+1 are overlapped due to the timing adjustment, the UE shall complete transmission of NB-IoT uplink slot *n* and not transmit the overlapped part of NB-IoT uplink slot *n*+1.

If the received downlink timing changes and is not compensated or is only partly compensated by the uplink timing adjustment without timing advance command as specified in [10], the UE changes *NTA* accordingly.

For a UE in a NTN serving cell, using serving satellite higher-layer ephemeris parameters, if configured, the UE determines $N\_{TA,adj}^{UE}$ (defined in [3]) using the 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 serving satellite, the UE determines $N\_{TA,adj}^{common} $(defined in [3]) based on one-way propagation delay $Delay\_{common}\left(t\right)$ which can be obtained as:

$$Delay\_{common}\left(t\right)=\frac{1}{2}\left[N\_{TA}^{common}+N\_{TA}^{commonDrift}×\left(t-t\_{epoch}\right)+N\_{TA}^{commonDriftVariation}×\left(t-t\_{epoch}\right)^{2} \right]$$

where $N\_{TA}^{common}$, $N\_{TA}^{commonDrift}$, and $N\_{TA}^{commonDriftVariation}$ are given by the higher layer parameters *nta-Common*, *nta-CommonDrift*, and *nta-CommonDriftVariation* respectively, and $t\_{epoch}$ is the epoch time given by the higher layer parameter *epochTime*. $Delay\_{common}(t)$ provides a distance at time $t$ between the serving satellite and the uplink time synchronization reference point divided by the speed of light. The uplink time synchronization reference

For a NB-IoT UE communicating over NTN, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of time units, where the quantity is provided by system information, as specified in 3GPP TS 36.331.

<Unchanged parts are omitted>