**3GPP TSG- Meeting #**

**Fukuoka City, Fukuoka, Japan, 20th - 24th May, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *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 |  | Core Network |  |

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | Resubmit the endorsed draft CR in R4-2403496 and R4-2406478There is [TBD] in NTA\_offset table 7.1C.2-3The side condition for Case 2 is not needed accoridng the latest agreement. |
|  |  |
| ***Summary of change:*** | Includes all changed in R4-2403496 and R4-2406478Change [TBD] to 0 in NTA\_offset table 7.1C.2-3Remove the side condition for Case 2 for previous endorsed version |
|  |  |
| ***Consequences if not approved:*** | The timing requeiments of VSAT UE in NTN bands above 10GHz are missing and incompleted in spec |
|  |  |
| ***Clauses affected:*** | 7.1C 7.2C 7.3C |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.533 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

==========================Start of change 1 =============================

## 7.1C UE transmit timing for Satellite Access

### 7.1C.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in connected state. The uplink frame transmission takes place $\left(N\_{TA}+N\_{TA-offset}+N\_{TA,adj}^{common}+N\_{TA,adj}^{UE}\right)×T\_{c}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

### 7.1C.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te\_NTN where the timing error limit value Te\_NTN.

Te\_NTN is specified in Table 7.1C.2-1 for FR1-NTN.

Te\_NTN is specified in Table 7.1C.2-2 and Table 7.1C.2-3 for VSAT UE in FR2-NTN.

This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission..

The UE shall meet the Te\_NTN requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $\left(N\_{TA}+N\_{TA-offset}+N\_{TA,adj}^{common}+N\_{TA,adj}^{UE}\right)×T\_{c}$.

The downlink timing is defined as the time when the first path (in time) of the corresponding downlink frame used by the UE to determine downlink timing is received from the reference cell at the UE antenna.

*N*TA for PRACH is defined as 0. $\left(N\_{TA}+N\_{TA-offset}+N\_{TA,adj}^{common}+N\_{TA,adj}^{UE}\right)×T\_{c}$ (in *T*c units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3 was applied. or after the last update in $N\_{TA,adj}^{common}$ or $N\_{TA,adj}^{UE}$.

The value of *N*TA-offset depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). *N*TA-offset is defined in Table 7.1.2-2 for FR1-NTN.

*N*TA-offset is defined in Table 7.1.2-2 for VSAT UE in FR2-NTN.

$N\_{TA,adj}^{common}$ and $N\_{TA,adj}^{UE}$ are as defined in TS38.211 [6].

Table 7.1C.2-1: Te\_NTN Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals (kHz) | Te\_NTN |
| FR1-NTN | 15 | 15 | 29\*64\*Tc |
|  |  | 30 | 24\*64\*Tc |
|  |  | 60 | N/A |
|  | 30 | 15 | 24\*64\*Tc |
|  |  | 30 | 22\*64\*Tc |
|  |  | 60 | N/A |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] |

Table 7.1C.2-2: Te\_NTN Timing Error Limit for fixed VSAT is served by GSO and fixed VSAT is served by NGSO

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals (kHz) | Te\_NTN |
| FR2-NTN | 120 | 60 | 13\*64\*Tc |
| 120 | 7.5\*64\*Tc |
| 240 | 60 | 13\*64\*Tc |
| 120 | 7.5\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] |

Table 7.1C.2-3: Te\_NTN Timing Error Limit for mobile VSAT is served by GSO

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals (kHz) | Te\_NTN |
| FR2-NTN | 120 | 60 | 13\*64\*Tc |
| 120 | [10]\*64\*Tc |
| 240 | 60 | 13\*64\*Tc |
| 120 | [10]\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] |

Fixed VSAT and mobile VSAT are defined in TS 38.101-5

Table 7.1C.2-3: The Value of for VSAT in FR2-NTN

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR2-NTN | 0 |
| Note 1: The UE identifies  based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of  is set as 0 for FR2-NTN band.  |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH including PUSCH transmissions in Time Domain Window when *pusch-DMRS-Bundling* is enabled, and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell, the updating of $N\_{TA,adj}^{common}$ and the updating of $N\_{TA,adj}^{UE}$, except when the timing advance in clause 7.3C is applied.

#### 7.1C.2.1 Gradual timing adjustment

When the transmission timing error between the UE and the reference timing exceeds ±Te\_NTN then the UE is required to adjust its timing to within ±Te\_NTN. The reference timing shall be $\left(N\_{TA}+N\_{TA-offset}+N\_{TA,adj}^{common}+N\_{TA,adj}^{UE}\right)×T\_{c}$ before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change, apart from a change of $N\_{TA,adj}^{UE}$ due to satellite position update and $N\_{TA,adj}^{common}$ between the previous transmission and the current transmission, in one adjustment shall be Tq\_NTN.

2) The minimum aggregate adjustment rate, apart from a change of $N\_{TA,adj}^{UE}$ due to satellite position update and $N\_{TA,adj}^{common}$ during the last one second, shall be Tp\_NTN per second.

3) The maximum aggregate adjustment rate, apart from a change of $N\_{TA,adj}^{UE}$ due to satellite position update and $N\_{TA,adj}^{common}$ during the last 200ms, shall be Tq\_NTN per 200 ms.

Where, the maximum autonomous time adjustment step Tq\_NTN and the aggregate adjustment rate Tp\_NTN are specified in Table 7.1C.2.1-1.

**Table 7.1C.2.1-1: Tq\_NTN Maximum Autonomous Time Adjustment Step and Tp\_NTN Minimum Aggregate Adjustment rate**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of uplink signals (kHz)** | **Tq\_NTN** | **Tp\_NTN** |
| FR1-NTN | 15 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 30 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 60 | N/A | N/A |
| FR2-NTN | 60 | 2.5\*64\*Tc | 2.5\*64\*Tc |
| 120 | 2.5\*64\*Tc | 2.5\*64\*Tc |
| NOTE: Tc is the basic timing unit defined in TS 38.211 [6] |

==========================End of change 1 =============================

==========================Start of change 2 =============================

## 7.2C UE timer accuracy for satellite access

### 7.2C.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

### 7.2C.2 Requirements

The requirements in this clause are applicable for both UE served by SAN in FR1 and VSAT UE served by SAN in FR2-NTN.

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to Table 7.2C.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or

- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. slot alignment when UE sends messages at timer expiry).

Table 7.2C.2-1

|  |  |
| --- | --- |
| **Timer value [s]** | **Accuracy** |
| timer value < 4 | ± 0.1s |
| timer value ≥ 4 | ± 2.5% |

==========================End of change 2=============================

==========================Start of change 3 =============================

## 7.3C Timing advance for satellite access

### 7.3C.1 Introduction

The timing advance is initiated by UE configured with only PCell served by SAN, upon initiating a validity timer for $N\_{TA,adj}^{common}$and $N\_{TA,adj}^{UE}$. The timing advance can be adjusted with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

### 7.3C.2 Requirements

#### 7.3C.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing from the beginning of uplink time slot *n*+ *k+1+2µ* $∙K\_{offset}$ for a timing advance command received in time slot *n*, and the value of *k, µ* and $K\_{offset}$ are defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

#### 7.3C.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions, apart from a change of $N\_{TA,adj}^{UE}$ and $N\_{TA,adj}^{common}$ between the preceding uplink transmission and the current transmission, with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 7.3C.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3C.2.2-1: UE Timing Advance adjustment accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 15 | 30 | 60 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | N/A |

Table 7.3C.2.2-2: UE Timing Advance adjustment accuracy for VSAT UE in FR2-NTN

|  |  |  |
| --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 60 | 120 |
| UE Timing Advance adjustment accuracy | 128 Tc | 32 Tc |
| NOTE 1: VSAT UE are defined in TS 38.101-5  |

*Editor’s Note: it would be further clarified with the additional conditions for TA adjustment accuracy requirement for satellite access*

==========================End of change 3=============================