**3GPP TSG-RAN4 Meeting # 111 *R4-2409653***

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

|  |
| --- |
| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **4580** | **rev** |  | **Current version:** | **18.5.0** |  |
|  |
| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)*** *on using this form: comprehensive instructions can be found at <http://www.3gpp.org/Change-Requests>.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

|  |
| --- |
|  |
| ***Title:***  | [NR\_ATG-Core] CR for timing of R18 ATG |
|  |  |
| ***Source to WG:*** | ZTE Corporation, Sanechips |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_ATG-Core |  | ***Date:*** | 2024-04-28 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-18 |
|  | *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:*** | Two types of issues need to be addressed:1. The 1st type: Some terminology in the formula is not aligned in different sections of the spec.
2. The 2nd type: Some inaccurate description exist.
 |
|  |  |
| ***Summary of change:*** | Two types of changes are included in this CR:1. The 1st type: revise some terminology in the formula to keep align in all spec.
2. The 2nd type: revise some inaccurate description.
 |
|  |  |
| ***Consequences if not approved:*** | Not accurate enough |
|  |  |
| ***Clauses affected:*** | 7.1D.1, 7.1D.2, 7.1D.2.1, 7.3D.1 |
|  |  |
|  | **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>

### 7.1D.1 Introduction

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

### 7.1D.2 Requirements

The ATG UE initial transmission timing error shall be less than or equal to ±Te\_ATG where the timing error limit value Te\_ATG is specified in Table 7.1D.2-1. 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 ATG UE shall meet the Te\_ATG requirement for an initial transmission provided that at least one SSB is available at the ATG UE during the last 160 ms. The reference point for the ATG UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $\left(N\_{TA}+N\_{TAoffset}+N\_{TA,adj}^{UE}\right)×T\_{c}$.

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

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

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.

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

Table 7.1D.2-1: Te\_ATG Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals (kHz) | Te\_ATG |
| 1 | 15 | 15 | 20\*64\*Tc |
|  |  | 30 | 18\*64\*Tc |
|  |  | 60 | N/A |
|  | 30 | 15 | 16\*64\*Tc |
|  |  | 30 | 16\*64\*Tc |
|  |  | 60 | N/A |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] |

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 and SRS transmission, the ATG UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell, the updating of $N\_{TA,adj}^{UE}$, except when the timing advance in clause 7.3D is applied.

#### 7.1D.2.1 Gradual timing adjustment

When the transmission timing error between the ATG UE and the reference timing exceeds ±Te\_ATG then the ATG UE is required to adjust its timing to within ±Te\_ATG. The reference timing shall be $\left(N\_{TA}+N\_{TAoffset}+N\_{TA,adj}^{UE}\right)×T\_{c}$ before the downlink timing of the reference cell. All adjustments made to the ATG 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 ATG UE position update, in one adjustment shall be Tq\_ATG.

2) The minimum aggregate adjustment rate, apart from a change of $N\_{TA,adj}^{UE}$ due to ATG UE position update, shall be Tp\_ATG per second.

3) The maximum aggregate adjustment rate, apart from a change of $N\_{TA,adj}^{UE}$ due to ATG UE position update, shall be Tq\_ATG per 200 ms.

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

Table 7.1D.2.1-1: Tq\_ATG Maximum Autonomous Time Adjustment Step and Tp\_ATG Minimum Aggregate Adjustment rate

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of uplink signals (kHz) | Tq\_ATG | Tp\_ATG  |
| 1 | 15 | 9.5\*64\*Tc | 9.5\*64\*Tc |
|  | 30 | 9.5\*64\*Tc | 9.5\*64\*Tc |
|  | 60 | N/A | N/A |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6] |

# <End of Change #1>

# <Start of Change #2>

## 7.3D Timing advance for ATG

### 7.3D.1 Introduction

The timing advance is initiated by ~~to~~ ATG UE configured with only PCell. 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].

### 7.3D.2 Requirements

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

ATG UE shall adjust the timing of its uplink transmission timing from the beginning of uplink at 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 ATG UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

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

The ATG UE shall adjust the timing of its transmissions, apart from a change of $N\_{TA,adj}^{UE}$ between the preceding uplink transmission and the current transmission, with a relative accuracy better than or equal to the ATG UE Timing Advance adjustment accuracy requirement in Table 7.3D.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 7.3D.2.2-1: ATG UE Timing Advance adjustment accuracy

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

*~~Editor’s Note: it would be further clairified with the additional conditions for TA adjustment accuracy requirement for ATG.~~*

# <End of Change #2>