**3GPP TSG-RAN WG4 Meeting #104-e *R4-2214625***

**Electronic, , 15th - 26th August 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **2521** | **rev** | **-** | **Current version:** | **17.6.0** |  |
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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 |  | Radio Access Network | **x** | Core Network |  |

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| ***Title:***  | CR to 38.133 on UL Transmit Timing in HST FR2 Scenario |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_HST\_FR2-Core |  | ***Date:*** | 2022-08-23 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *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:*** | The period when lower UL transmit timing accuracy ([7Ts]) after TCI state switch in HST FR2 scenario is not limited.Currently, UL transmit timing requirements in HST FR2 scenario are defined only for the case when large one-step UL transmit timing adjustment is enabled and supported. |
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| ***Summary of change:*** | Extended UL transmit timing requirement in Clause 7.1.2 on the first transmission after the TCI state switch.Defined the latest time when UE can be able to follow the requirement in clause 7.1.2.1 again after the TCI state switch.Editorial corrections. |
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| ***Consequences if not approved:*** | UL transmit timing requirements are not fully defined for HST FR2 scenario. NW does not have information when UE is able to transmit in UL with timing error within Te after the TCI switch. |
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| ***Clauses affected:*** | 7.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Revision of R4-2213399. |

## START OF CHANGE

# 7 Timing

## 7.1 UE transmit timing

### 7.1.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in connected state or when transmiting PUSCH on CG resources for SDT in RRC\_Inactive. The uplink frame transmission takes place before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. For serving cell(s) in pTAG, UE shall use the SpCell as the reference cell for deriving the UE transmit timing for cells in the pTAG. For serving cell(s) in sTAG, UE shall use any of the activated SCells as the reference cell for deriving the UE transmit timing for the cells in the sTAG. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

In the requirements of clause 7.1.2, the term reference cell on a carrier frequency subject to CCA is not available at the UE refers to when at least one SSB is configured by gNB, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available during at least one discovery burst transmission window, at the UE due to DL CCA failures at gNB during the last 1280 ms; otherwise the reference cell on the carrier frequency subject to CCA is considered as available at the UE.

### 7.1.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.1.2-1. 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, or it is the first transmission sent on the PSCell for activating the deactivated SCG without RACH.

- when it is the transmission for PUSCH on CG resources for SDT in RRC\_Inactive.

When the UL SCS is 120 kHz or smaller, the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. When the UL SCS is 480 kHz the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available in the last 80 ms. When the UL SCS is 960 kHz the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available in the last 40 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus . 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.

 (in *Tc* 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. *N*TA for other channels is not changed until next timing advance is received. The value ofdepends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). is defined in Table 7.1.2-2.

Table 7.1.2-1: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals (kHz) | Te |
| 1 | 15 | 15 | 12\*64\*Tc |
|  |  | 30 | 10\*64\*Tc |
|  |  | 60 | 10\*64\*Tc |
|  | 30 | 15 | 8\*64\*Tc |
|  |  | 30 | 8\*64\*Tc |
|  |  | 60 | 7\*64\*Tc |
| 2-1 | 120 | 60 | 3.5\*64\*Tc |
|  |  | 120 | 3.5\*64\*Tc |
|  | 240 | 60 | 3\*64\*Tc |
|  |  | 120 | 3\*64\*Tc |
| 2-2 | 120 | 120 | 3.5\*64\*Tc |
|  |  | 480 | [1.58]\*64\*Tc |
|  | 480 | 120 | 2.86\*64\*Tc |
|  |  | 480 | [1.35]\*64\*Tc |
|  |  | 960 | [0.90]\*64\*Tc |
|  | 960 | 120 | 2.80\*64\*Tc |
|  |  | 480 | [1.13]\*64\*Tc |
|  |  | 960 | [0.86]\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] |

Table 7.1.2-2: The Value of 

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case  | 25600 (Note 1) |
| FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case  | 0 (Note 1) |
| FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case | 39936 (Note 1) |
| FR2 | 13792 |
| 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 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of n-TimingAdvanceOffset is provided for all the UL carriers according to clause 4.2 in TS 38.213 [3] and the value 39936 of  can also be provided for a FDD serving cell.Note 2: Void |

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 UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3 is applied.

Table 7.1.2-3: void

If the UE uses a reference cell on a carrier frequency subject to CCA for deriving the UE transmit timing, then the UE shall meet all the transmit timing requirements defined in clause 7.1.2 provided that the reference cell is available at the UE. If the reference cell is not available at the UE on a carrier frequency subject to CCA, then the UE is allowed to transmit in the uplink provided that the UE meets all the transmit timing requirements defined in clause 7.1.2; otherwise the UE shall not transmit any uplink signal.

If a reference cell on a carrier frequency belonging to the PTAG, which is subject to CCA, is not available at the UE then the UE is allowed to use any of available activated SCell(s) at the UE in PTAG as a new reference cell. If the SCell used as reference cell is deactivated, or becomes not available, the UE is allowed to use another active serving cell in PTAG as new reference cell.

If a reference cell on a carrier frequency belonging to the STAG, which is subject to CCA is not available at the UE then the UE is allowed to use any of available activated SCell(s) at the UE in STAG as a new reference cell.

#### 7.1.2.1 Gradual timing adjustment

Requirements in this section shall apply regardless of whether the reference cell is on a carrier frequency subject to CCA or not.

When the transmission timing error between the UE and the reference timing exceeds ±Te then the UE is required to adjust its timing to within ±Te. The reference timing shall be  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 in one adjustment shall be Tq.

2) The minimum aggregate adjustment rate shall be Tp per second.

3) The maximum aggregate adjustment rate shall be Tq per 200 ms for SCS of UL signals smaller or equal to 120 kHz and 100 ms for SCS of upling signals larger or equal to 480 kHz.

 where the maximum autonomous time adjustment step Tq and the aggregate adjustment rate Tp are specified in Table 7.1.2.1-1.

Table 7.1.2.1-1: Tq Maximum Autonomous Time Adjustment Step and Tp Minimum Aggregate Adjustment rate

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of uplink signals (kHz) | Tq | Tp  |
| 1 | 15 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 30 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 60 | 5.5\*64\*Tc | 5.5\*64\*Tc |
| 2-1 | 60 | K\*64\*Tc | 2.5\*64\*Tc |
|  | 120 | K\*64\*Tc | 2.5\*64\*Tc |
| 2-2 | 120 | 2.5\*64\*Tc | 2.5\*64\*Tc |
|  | 480 | [0.8]\*64\*Tc | [0.8]\*64\*Tc |
|  | 960 | [0.8]\*64\*Tc | [0.8]\*64\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]NOTE 2: When [*highSpeedMeasFlagFR2-r17*] is configured for UE supporting power class 6, K = 4.5; otherwise, when [*highSpeedMeasFlagFR2-r17*] is not configured K = 2.5. |

#### 7.1.2.2 Void

Table 7.1.2.2-1: Void

#### 7.1.2.3 One shot large UL timing adjustment for FR2 Power Class 6 UE

When *highSpeedMeasFlagFR2-r17* is configured and *highSpeedLargeOneStepUL-TimingFR2-r17* is enabled for UE supporting FR2 power class 6 and [*largeOneStepUL-timingFR2-r17*] capability, the following requirements apply to the UE:

- If the absolute value , the requirement in clause 7.1.2.1 apply to the first UL transmission after a TCI state switch.

- Otherwise, the UE transmit timing immediately after TCI state switch shall be and clause 7.1.2.1 requirements don’t apply.

- The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to ±Te as specified in clause 7.1.2 if the new target TCI state is within active TCI state list, otherwise ±[7\*64\*Tc], and the reference point is .

Above,

- (in units) is the DL timing defined as the time when UE receives downlink frame with new target TCI state.

- (in units) is the DL timing defined as the time when UE receives downlink frame with old source TCI state.

## END OF CHANGE#2