**3GPP TSG RAN WG4 Meeting #95-e R4-2008599**

**Electronic Meeting, May 25-June 05, 2020**

**Agenda Item:** 6.5.3.3

**Source:** Nokia, Nokia Shanghai Bell

**Title:** TP to TS 38.174 V0.0.1: Correction on Transmit Timing requirements for IAB

**Document for:** Approval

1. Introduction

In RAN4#94e-bis meeting, TP on 38.174 RRM requirements was agreed in R4-2004801. In this TP, the below changes are made for the IAB-MT Timing requirements:

1) Add CA supporting for IAB-MT

2) Add DRX mode support since RAN2 agreed that DRX is optional for IAB-MT.

3) Change the limitation from 160ms to 640ms for IAB-MT to meet the Te requirement for an initial transmission as the maximum SSB periodicity for IAB-MT is 640ms

These additional changes in RAN4#95e on top of R4-2004801 have been highlighted.

# Text Proposal

--------------------------------------------------Start of TP------------------------------------------------------

## 12.2 Timing

### 12.2.1 IAB-MT transmit timing

*Editor notes: The terminology of “downlink” and “uplink” could be revised and aligned with RF conclusion.*

#### 12.2.1.1 Introduction

The IAB-MT shall have capability to follow the frame timing change of the reference cell in connected state. 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, IAB-MT shall use the SpCell as the reference cell for deriving the IAB-MT transmit timing for cells in the PTAG. IAB-MT initial transmit timing accuracy, gradual timing adjustment requirements are defined in the following requirements.

#### 12.2.1.2 Requirements

The IAB-MT initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 12.2.1.2-1. This requirement applies when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS or it is the PRACH transmission.

The IAB-MT shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the IAB-MT during the last 640 ms. The reference point for the IAB-MT 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 detected path (in time) of the corresponding downlink frame is received from the reference cell. *N*TA for PRACH is defined as 0.

 (in *Tc* units) for other channels is the difference between IAB-MT transmission timing and the downlink timing immediately after when the last timing advance in clause 12.2.2 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 12.2.1.2-2.

Table 12.2.1.2-1: 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 | 120 | 60 | 3.5\*64\*Tc |
| 120 | 3.5\*64\*Tc |
| 240 | 60 | 3\*64\*Tc |
| 120 | 3\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [TBD] |

Table 12.2.1.2-2: The Value of 

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR1 TDD band without LTE-NR coexistence case  | 25600 (Note 1) |
| FR1 TDD band with LTE-NR coexistence case | 39936 (Note 1) |
| FR2 | 13792 |
| Note 1: The IAB-MT identifies  based on the information n-TimingAdvanceOffset as specified in TS 38.331 [TBD]. If IAB-MT is not provided with the information n-TimingAdvanceOffset, the default value of  is set as 25600 for FR1 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 and SRS transmission, the IAB-MT 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 12.2.2 is applied.

##### 12.2.1.2.1 Gradual timing adjustment

When the transmission timing error between the IAB-MT and the reference timing exceeds ±Te then the IAB-MT 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 IAB-MT 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.

where the maximum autonomous time adjustment step Tq and the aggregate adjustment rate Tp are specified in Table 12.2.1.2.1-1.

Table 12.2.1.2.1-1: 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 | 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 [TBD] |

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