3GPP TSG-RAN WG1 Meeting #109-e R1-221XXXX

e-Meeting, May 9th – 20th, 2022

**Title: DRAFT** LS on UL Segmented Transmission for UL synchronization for IoT NTN

**Reply to:**

**Release:** Release 17

**Work Item:** LTE\_NBIOT\_eMTC\_NTN

**Source:** Moderator (MediaTek), [RAN1]

**To:** RAN4

**Cc:**

**Contact Person:**

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**Attachments:** None

**1. Overall Description:**

RAN1 has discussed the following aspects and leaves it up to RAN4 to specify UL Segmented Transmission for UL synchronization for IoT NTN as follows:

* UE applies segmented UL transmission according to duration configuration by the network
* Single UE capability governs UE behavior w.r.t gaps between segments for PUSCH, PUCCH and NPUSCH, when the UE performs segmented pre-compensation
* When capability is NOT signalled: UE follows legacy behaviour at slot boundaries due to TA adjustment
* Adopt the following TPs
	+ TP#1 from R1-2203388 on TS 36.211 Section 5.3.4 for PUSCH for segmented transmission
	+ TP#2 from R1-2203388 on TS 36.211 Section 5.4.3 for PUCCH for segmented transmission
	+ TP#3 from R1-2203388 on TS 36.211 Section 10.1.3.6 for NPUSCH for segmented transmission
* Different values (e.g., TA) for pre-compensation are applied per segment

RAN1 respectfully requests RAN4 to prioritize the UL Segmented Transmission for UL synchronization for IoT NTN work by considering introducing the above.

Relevant RAN1 agreements are attached below.

**Agreement in 8.14 for IoT NTN**

UE pre-compensation per segment of NPUSCH for NB-IoT and PUSCH/PUCCH for eMTC is applied from one segment to the next segment by using one or more of the following methods if supported by UE implementation

 1. UE may drop / Insert samples / Puncture OFDM symbols

 2. UE may blank subframes / slots where UE skip a slot or a subframe

The total transmission time is not changed

UE autonomously Drop / insert samples / Puncture OFDM symbols or Blank subframes / slots where UE drops a subframe / slot

The method used for the UE pre-compensation is known to the eNB by a single UE capability

* UE Blank subframes / slots where UE skip a slot or a subframe (slot is based on Sub Carrier Spacing)

FFS Details of method(s) to drop / insert samples, blanking subframes / slots (slot is based on Sub Carrier Spacing)

* The single UE capability that governs UE behavior w.r.t gaps between segments for PUSCH, PUCCH and NPUSCH, when the UE performs segmented pre-compensation, is as follows:
	+ When a single capability is signalled: UE drops one or more of the following durations of uplink transmission between segments (indicated by the capability):
		- 1 slot (applicable to eMTC)
		- 1 subframe (applicable to eMTC)
		- 1 slot (applicable to NB-IoT)
		- 2 slots (applicable to NB-IoT)
		- 1 symbol (applicable to both eMTC and NB-IoT)
		- UE follows legacy behaviour at slot boundaries due to TA adjustment
	+ When capability is NOT signalled: UE follows legacy behaviour at slot boundaries due to TA adjustment

**Agreement in 8.14 for IoT NTN**

* TP#1 (for TS36.211 v17.1.0, clause 5.3.4) in section 5.1 of R1-2203388 is endorsed in principle, with the following note to the editor: the TP proposes entirely new text, the strikeout text is not a deletion of existing text, and the bold text is not intended to be bold.
* TP#2 (for TS36.211 v17.1.0, clause 5.4.3) in section 5.1 of R1-2203388 is endorsed in principle, with the following note to the editor: the TP proposes entirely new text, the strikeout text is not a deletion of existing text, and the bold text is not intended to be bold.
* TP#3 (for TS36.211 v17.1.0, clause 10.1.3.6) in section 5.1 of R1-2203388 is endorsed in principle, with the following note to the editor: the TP proposes entirely new text, the strikeout text is not a deletion of existing text, and the bold text is not intended to be bold.

The TP#1, TP#2, and TP#3 in R1-2203388 with revisions as in RAN1 agreement above are copied below for convenience.

***<TP1, Section 5.3.4, TS 36.211>***

For BL/CE UEs communicating over NTN, for PUSCH transmission, for frame structure type 1, after a transmission duration of $N\_{segment}^{precompensation}$ time units (which may include subframes that are not BL/CE UL subframes), a transmission gap of $N\_{gap}^{precompensation}$time units shall be counted for the PUSCH resource mapping but not used for transmission of the PUSCH, according to the single UE capability *ue-CE-NeedSegmentedPrecompensationGaps*, as specified in 3GPP TS 36.331. The quantity $N\_{segment}^{precompensation}$ is provided by higher layers, and the quantity of$N\_{gap}^{precompensation}$ is configured by the higher layers based on the UE capability if signalled.

***<END TP1>***

**“reason for change”** Clarify UE behaviour w.r.t gaps between segments for PUSCH when the UE performs segmented pre-compensation

**“summary of change”** a transmission gap of $N\_{gap}^{precompensation}$time units shall be counted for the PUSCH resource mapping but not used for transmission of the PUSCH, according to the single UE capability ue-CE-NeedSegmentedPrecompensationGaps, as specified in 3GPP TS 36.331. The quantity $N\_{segment}^{precompensation}$ is provided by higher layers, and the quantity of $N\_{gap}^{precompensation}$ is based on the UE capability as configured by the higher layers.

**“consequence if not approved”** Release 17 eMTC UE cannot communicate via GEO and NGSO NTNs

***<TP2, Section 5.4.3, TS 36.211>***

For BL/CE UEs communicating over NTN, for PUCCH transmission, for frame structure type 1, after a transmission duration of $N\_{segment}^{precompensation}$ time units (which may include subframes that are not BL/CE UL subframes), a transmission gap of $N\_{gap}^{precompensation}$ time units shall be counted for the PUCCH resource mapping but not used for transmission of the PUCCH, according to the single UE capability *ue-CE-NeedSegmentedPrecompensationGaps*, as specified in 3GPP TS 36.331. The quantity $N\_{segment}^{precompensation}$ is provided by higher layers, and the quantity $N\_{gap}^{precompensation}$ isconfigured by the higher layers based on the UE capability if signalled.

***<END TP2>***

**“reason for change”** Clarify UE behaviour w.r.t gaps between segments for PUCCH when the UE performs segmented pre-compensation

**“summary of change”** a transmission gap of $N\_{gap}^{precompensation}$ time units shall be counted for the PUCCH resource mapping but not used for transmission of the PUCCH, according to the single UE capability ue-CE-NeedSegmentedPrecompensationGaps, as specified in 3GPP TS 36.331

**“consequence if not approved”** Release 17 eMTC UE cannot communicate via GEO and NGSO NTNs

***<TP3, Section 10.1.3.6, TS 36.211>***

For a UE communicating over NTN, after transmissions (and/or postponements due to NPRACH) of $N\_{segment}^{precompensation}$ time units, for frame structure type 1, a transmission gap of $N\_{gap}^{precompensation}$ time units shall be counted for the NPUSCH resource mapping but not used for transmission of the NPUSCH according to the UE capability *ue-NBIOT-NeedSegmentedPrecompensationGaps* , as specified in 3GPP TS 36.331. The quantity $N\_{segment}^{precompensation}$ is provided by higher layers,  and the quantity of $N\_{gap}^{precompensation}$ is configured by the higher layers based on the UE capability if signalled.

**<END TP3>**

**“reason for change”** Clarify UE behaviour w.r.t gaps between segments for NPUSCH when the UE performs segmented pre-compensation

**“summary of change”** a transmission gap of $N\_{gap}^{precompensation}$ time units shall be counted for the NPUSCH resource mapping but not used for transmission of the NPUSCH according to the UE capability ue-NBIOT-NeedSegmentedPrecompensationGaps , as specified in 3GPP TS 36.331

**“consequence if not approved”** Release 17 NB-IoT UE cannot communicate via NGSO NTNs

**Agreement in 8.16.4 UE features for LTE\_NBIOT\_eMTC\_NTN:**

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | Segmented UL transmission for eMTC  | UE applies segmented UL transmission according to duration configuration by the network  | 2-1 | Yes | N/A | [Release 17 eMTC UE cannot communicate via GEO and NGSO NTNs] | Per UE | No | No | [For UEs supporting communication via GEO and NGSO NTNs, it must indicate this FG is supported.] | Optional with capability signallingNote: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported |

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1c | Segmented UL transmission for NB-IoT | UE applies segmented UL transmission according to duration configuration by the network  | 2-1b | Yes | N/A | Release 17 NB-IoT UE cannot communicate via NGSO NTNs | [Per UE/per band] | No | No | For UEs supporting communication via NGSO NTNs, it must indicate this FG is supported. | Optional with capability signallingNote: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported |

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1d | Segmented UL transmission for eMTC  | Single UE capability | 2-1, 2-1a | Yes | N/A | Release 17 eMTC UE cannot communicate via GEO and NGSO NTNs | Per UE | No | No | For UEs supporting communication via GEO and NGSO NTNs, it must indicate this FG is supported. | Optional with capability signallingNote: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported |
| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1e | Segmented UL transmission for NB-IoT | Single UE capability | 2-1b, 2-1c | Yes | N/A | Release 17 NB-IoT UE cannot communicate via NGSO NTNs | Per UE | No | No | For UEs supporting communication via NGSO NTNs, it must indicate this FG is supported. | Optional with capability signallingNote: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported |

**2. Actions:**

**To RAN4 group:**

**ACTION:** RAN1 respectfully asks RAN4 to take the above into account for future work.

**3. Date of Next TSG-RAN WG1 Meetings:**

TSG-RAN WG1 Meeting #110 22 – 26 August 2022

TSG-RAN WG1 Meeting #110bis 10 – 19 October 2022