3GPP TSG RAN WG1 #109-e R1-220xxxx

**e-Meeting, May 9th - 20th, 2022**

**Title:** LS on New UE Feature for HARQ-ACK multiplexing on PUSCH in the absence of PUCCH

**Release:** Rel-16

**Work Item:** TEI16, NR\_newRAT-Core

**Source:** RAN WG1

**Response to: -**

**To:** RAN WG2

**Cc:**

**Contact Person:**

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**Attachments:** None

**1. Overall Description:**

In the current specification, the UE behavior is unknown when a PUSCH is scheduled by a DAI field in a PUCCH slot but the UE does not determine any PUCCH resource with HARQ-ACK information for transmission in the PUCCH slot. RAN WG1 has agreed on a solution to the case where there are multiple PUSCHs within the PUCCH slot subject to a new Rel-16 UE capability *Multiplexing-HARQ-ACK-without-PUCCH-on-PUSCH* as follows:

**Agreement**

For Rel-16 UEs, in the scenario with more than one PUSCH (overlapping and non-overlapping) and no overlapping PUCCH with HARQ-ACK within a span on one PUCCH slot (both single carrier and UL CA), for a unified design, the following should be specified:

1. Selection of the  candidate PUSCH for multiplexing:  PUSCHs without UL-TDAI=4 in case Type 2 CB, and without UL-TDAI n.e. 1 in case of Type 1 CB within the PUCCH slot are candidates
2. Prioritization rules to select PUSCH for multiplexing. Prioritization rules are identical to 38.213
3. Limitations for multiplexing
	* UE expects to multiplex HARQ-ACK on only 1 PUSCH selected based on step 2 in the PUCCH slot.
	* All the PUSCHs in the determined candidate set after step 1 have to satisfy Rel-15 UCI multiplexing timeline, defined with respect the starting symbol of the earliest PUSCH transmission in the candidate set.

The above specified behaviour is supported subject to a new Rel-16 UE capability [xxxxx]

* FFS: the details of the capability signaling

**Agreement**

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/****Optional** |
| 22. NR Others | 22-12 | Multiplexing HARQ-ACK without PUCCH on PUSCH | 1.      multiplexing HARQ-ACK in a PUSCH in a PUCCH slot when the UE misses any HARQ-ACK to transmit in any PUCCH but receives UL grant(s) with UL-TDAI field to transmit **multiple**PUSCHs in the PUCCH slot |  | Yes | N/A |   | FFS: Per UE or Per Band | FFS | FFS | N/A |  | Optional |

**2. Actions:**

**To RAN WG2:**

**ACTION:** RAN1 respectfully asks RAN2 to implement the newly defined UE feature in their specification.

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

TSG RAN1 #110 22 – 26 August 2022 Toulouse, FR

TSG RAN1 #110-bis-e 10 – 19 October 2022 Online