

# Discussion on Rel-17 enhanced URLLC/IIOT WID scope

vivo

# Progress for HARQ-ACK feedback enhancements

- Diverse enhancements are proposed, too many topics to be studied in a work item!

Topic	Status
1. SPS HARQ-ACK dropping for TDD	Agreed to <b>support with high priority</b> and focus on two options <ul style="list-style-type: none"> <li>• Option 1: Deferring HARQ-ACK until a next (e.g., first) available PUCCH</li> <li>• <b>Option 2: Dynamic triggering of a one-shot / Type-3 CB type of re-transmission</b></li> </ul>
2. SPS HARQ-ACK skipping for 'skipped' SPS PDSCH	Agreed to <b>study</b> with focusing on two Alternatives <ul style="list-style-type: none"> <li>• 'NACK skipping' for (skipped) SPS PDSCH (Alt. 1)</li> <li>• Dynamic indication of skipped SPS PDSCH occasions (Alt. 3)</li> </ul>
3. SPS HARQ payload size reduction	Agreed to <b>study</b> with focusing on four Alternatives <ul style="list-style-type: none"> <li>• ACK skipping (NACK-only) (Alt. 1)</li> <li>• <b>NACK skipping (ACK-only) (Alt. 2)</b></li> <li>• HARQ bundling / compression (Alt. 3)</li> <li>• HARQ-ACK disabling /skipping for certain SPS configurations (Alt. 4)</li> </ul>
<b>4. Retransmission of cancelled HARQ</b>	No agreement yet. <b>Majority companies support enh. For Type 3 HARQ codebook: 14x Yes vs 4x No vs 1x FFS</b>
5. Type 1 HARQ codebook based on sub-slot PUCCH config.	No agreement yet. Majority companies are positive to support it: 16x Yes vs 2x No vs 4x FFS
6. PUCCH repetition enhancements	No agreement yet. RP-202110: Handling of overlapped objectives involving Rel-17 feMIMO, Rel-17 IIoT/URLLC and Rel-17 Coverage Enhancements is to be discussed in RAN#90-e.
7. PUCCH carrier switching for HARQ feedback	Agreed to <b>study</b> only for cells that are part of the active UL CA configuration. <ul style="list-style-type: none"> <li>• Alt. 1 - Dynamic indication of PUCCH carrier switching: 4x Yes, 10xNo, 3x FFS</li> <li>• Alt. 2 – PUCCH cell switching based on semi-static configuration: 8x Yes, 5x No, 4x FFS</li> </ul>
8. Other enh.	...

# Progress on CSI feedback enhancements

- Too broad WID scope for CSI feedback enhancement
  - 15 CSI enhanced schemes proposed, and the number of schemes are still increasing
- Two RAN1 meetings were spent for clarifying the scope, agreed
  - Baseline simulation assumptions
  - No change for CSI processing time relative to Rel-16 CSI in this WI
  - No CSI feedback enhancement for Multi-TRP transmission in this WI
  - Continue studying Case-1 new reporting

Scheme 1a	Scheme 1b	Scheme 1c	Scheme 1d	Scheme 1e
CQI/SINR statistics	Interference statistics	Modify existing reporting format (e.g., the worst subbands CQI reporting, Subband CQI granularity)	CSI expiration time	partial information (e.g., interference) update

- Continue studying Case-2: new reporting based on PDSCH decoding for OLLA performance enhancement

# Progress for URLLC/IoT on Unlicensed Band and Intra-UE multiplexing and prioritization

- Status for URLLC/IoT on Unlicensed Band:
  - For the support of UE-initiated COT for FBE → good progress in general
  - For the harmonization of UL Configured Grant → reasonable progress
- Status for Intra-UE multiplexing and prioritization:

Topic	Status
1. UCI multiplexing with different priorities	High-level agreements to support for some scenarios, see table 1. <b>But many details are FFS</b>
2. PHY Pri. for DG and CG collision <ul style="list-style-type: none"> <li>• Low-priority (LP) DG-PUSCH vs. high-priority (HP) CG-PUSCH</li> <li>• HP DG-PUSCH vs. LP CG PUSCH</li> </ul>	Agreed to support Rel-16 discussions can be baseline
3. Simultaneous PUCCH/PUSCH transmissions	Agreed to support at least for inter-band CA <b>with FFS details</b>

Table 1 UCI multiplexing scenarios

	HP SR	HP HARQ-ACK	HP HARQ-ACK+SR	HP PUSCH (UL-SCH only)	HP PUSCH + HP HARQ-ACK and/or CSI
LP HARQ-ACK	agreed	agreed	agreed	agreed	agreed
LP PUSCH (UL-SCH only)	Pending (HP)	agreed	agreed	N/A	N/A
LP PUSCH + LP HARQ-ACK and/or CSI	Pending (HP)	agreed	agreed	N/A	N/A
LP SR	pending	pending	pending	pending	pending
CSI	pending	pending	pending	pending	pending

# Observations and Suggestions

- Observations:
  - Except the enhancements for unlicensed band URLLC/IIoT, less progress are made for HARQ-ACK, CSI feedback enhancements. Some high level agreements made for intra-UE prioritization/multiplexing
  - For HARQ-ACK and CSI feedback enhancements, the study scope is too broad. Without a clear time plan for the study phase, there can be risk of completing the specification by the end of Dec. 2021.
    - Based on Rel-16 URLLC/IIoT experience, moving many details from the Rel-17 WI to the Rel-17 maintenance phase should be avoided
  - More focused discussion is necessary for HARQ-ACK and CSI feedback enhancements, clear guideline for the completion date for study phase given by RAN is helpful.
- Proposal: To ensure the timely completion of Rel-17 URLLC/IIOT WI, RAN to agree 2021Q1 as the target completion date for the “study phase” for the following objectives
  - UE feedback enhancements for HARQ-ACK [RAN1]
  - CSI feedback enhancements to allow for more accurate MCS selection [RAN1]

# Annex

# Annex

Based on RP-202111 (Release, Meeting and TU planning) and RP-193233 Time budget for NR\_IIOT\_URLLC\_enh, **estimated** timeline for Rel-17 IIoT/URLLC WI

		2020		2021						2022				
		Q3	Q4	Q1	Q2		Q3	Q4		Q1		Q2	Q3	Q4
RAN1		102	103	104	104B	105	106	106B	107	107B	108			
TU		2	2	2	3	1	1	1	1	--	--			
RAN2		111	112  <a href="#">here!</a>	113	113B	114	115	115B	116	116B	117			
TU		1	1	1	0	1	1	1	0	0.5	1			

Current Release 17 timeline as per RAN#87E decision

Rel-17 RAN1 freeze

Rel-17 stage-3 freeze

Rel-17 ASN.1 freeze

Rel-17 RAN4 performance completion

**Potential new timeline** to be committed to latest in Dec

Rel-17 RAN1 freeze

Rel-17 stage-3 freeze

Rel-17 ASN.1 freeze

Rel-17 RAN4 performance completion

# Annex

## Rel-17 WID objectives (RP-201310)

1. Study, identify and specify if needed, required Physical Layer feedback enhancements for meeting URLLC requirements covering
  - UE feedback enhancements for HARQ-ACK [RAN1]
  - CSI feedback enhancements to allow for more accurate MCS selection [RAN1]
  - Note: DMRS-based CSI feedback is not in scope of this WI
2. Uplink enhancements for URLLC in unlicensed controlled environments [RAN1, RAN2]:
  - a. Specify support for UE-initiated COT for FBE with minimum specification effort
  - b. Harmonizing UL configured-grant enhancements in NR-U and URLLC introduced in Rel-16 to be applicable for unlicensed spectrum
3. Intra-UE multiplexing and prioritization of traffic with different priority based on work done in Rel.16 [RAN1]:
  - a. Specify multiplexing behavior among HARQ-ACK/SR/CSI and PUSCH for traffic with different priorities, including the cases with UCI on PUCCH and UCI on PUSCH.
  - b. Specify PHY prioritization of overlapping dynamic grant PUSCH and configured grant PUSCH of different PHY priorities on a BWP of a serving cell including the related cancelation behavior for the PUSCH of lower PHY priority, taking the solution developed during Rel-16 as the baseline
4. Enhancements for support of time synchronization:
  - a. RAN impacts of SA2 work on uplink time synchronization for TSN, if any. [RAN2]
  - b. Propagation delay compensation enhancements (including mobility issues, if any). [RAN2, RAN1, RAN3, RAN4]
5. RAN enhancements based on new QoS related parameters if any, e.g. survival time, burst spread, decided in SA2. [RAN2, RAN3]