**3GPP TSG RAN WG1 Meeting #100bis                     R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Agenda Item: 7.2.2.2.3**

**Source: Moderator (Huawei)**

**Title: Feature lead summary#1 on email discussion 100b-e-NR-unlic-NRU-HARQ-01 (Type-3 HARQ-ACK codebook)**

**Document for: Discussion and Decision**

# Introduction

This document provides updated proposals on issues B1, B9, B10 that are prioritized for RAN1#100b-e among the issues identified for the **NR-U Type-3 HARQ-ACK codebook** during the preparation phase.

[100b-e-NR-unlic-NRU-HARQ-01] Email discussion/approval on following issues related to Type-3 HARQ-ACK codebook by 4/23; if necessary, followed by endorsing the corresponding TPs by 4/29 – David (Huawei)

* Issue B1: Remaining details on triggering Type-3 HARQ-ACK codebook feedback with a DCI that does not schedule a PDSCH
* Issue B10: Clarification to remove unintended limitations on Type-3 HARQ-ACK codebook usage (when no NNK1 value was received, when the UE is configured with semi-static codebook)
* Issue B9: Clarification that Type-3 HARQ-ACK codebook feedback should be generated for all configured serving cells

Each sub-section per issue (and sub-issue) includes an initial FL proposal based on the summary of the submitted Tdocs, and provides a table for collecting companies’ views on the FL’s proposal.

# Discussion

## Issue B1

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| B1 | Remaining details on triggering Type-3 HARQ-ACK codebook feedback with a DCI that does not schedule a PDSCH:  Issue 1: to determine the value of the FDRA field, avoiding ambiguities with dormancy non-scheduling PDCCH and with validation for SPS release  Issue 2: to define reference slot corresponding to K1=0 when no PDSCH is scheduled  Issue 3: to determine the UE processing time applied for the one-shot HARQ-ACK feedback triggered by the PDSCH-less DCI |

#### Issue 1 (value of the FDRA field)

For issue 1, a majority of companies proposed to confirm the working assumption to use one value of the frequency domain resource assignment field indicates that this DCI does not schedule a PDSCH. A majority of companies proposed to use all ‘0’ FDRA for resourceAllocationType0 and all ‘1’ FDRA for resourceAllocationType 1 with one-shot HARQ-ACK request field with value 1 in DCI Format 1\_1 to signal one-shot HARQ-ACK request without scheduling PDSCH. In this case, the UE does not consider the DCI format as indicating an active DL BWP provided by dormant-BWP or by first-non-dormant-BWP-ID-for-DCI-inside-active-time, if any, and the validation for SPS release as described in Clause 10.2 is not achieved.

One company proposed further clarifications to the proposal above to solve potential ambiguity due to truncated FDRA field in case of BWP switching, UE is expected to receive PDSCH when the UE is triggered to feedback one-shot HARQ-ACK by the DCI which indicates different BWP from the current active BWP for resource allocation type 1. A corresponding TP for clause 12 is proposed: “A UE is not expected to receive the DCI format 1\_1 in which the One-shot HARQ-ACK request field is set to 1, and the size of frequency domain resource assignment field is different from the one required for the DCI format 1\_1 interpretation for the DL BWP that is indicated by the bandwidth part indicator.”.

Proposal from FL: take the majority proposal (no new DCI field)

* Use all ‘0’ FDRA for resourceAllocationType0 and all ‘1’ FDRA for resourceAllocationType 1 with one-shot HARQ-ACK request field with value 1 in DCI Format 1\_1 to signal Type-3 HARQ-ACK request without scheduling PDSCH.
  + Clarify in the specifications that in this case, the UE does not consider the DCI format as indicating an active DL BWP provided by dormant-BWP or by first-non-dormant-BWP-ID-for-DCI-inside-active-time, if any, and the validation for SPS release as described in Clause 10.2 is not achieved.
* Corresponding TP(s) to be developed as follows:
  + TP for 38.212 clause 7.3.1.2.2 (DCI format 1\_1)
    - Clarify condition (according to the above) in which SCell dormancy indication is not indicated by the fields in the DCI
    - Clarify condition (according to the above) in which DL-SCH is not transmitted
      * Note: several TPs proposed to specify this in 38.213 section 9.1.4 instead
  + TP for 38.213 clauses
    - Clause 10.2: clarify which signaling values don’t apply for a DCI indicating PDCCH validation for DL SPS
    - Clause 10.3: clarify which signaling values don’t apply for a DCI indicating an active DL BWP provided by dormant-BWP or by first-non-dormant-BWP-ID-for-DCI-inside-active-time
    - Clause 12: is there a need for the following TP?
      * “A UE is not expected to receive the DCI format 1\_1 in which the One-shot HARQ-ACK request field is set to 1, and the size of frequency domain resource assignment field is different from the one required for the DCI format 1\_1 interpretation for the DL BWP that is indicated by the bandwidth part indicator.”

Please complete/revise/add your company’s view on the proposal in the table below.

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| **Company** | **Comments on FL proposal** |
| OPPO | In our Tdoc we pointed out this issue, but we are fine with any TP as long as the issue is addressed. |
| Nokia, NSB | We would have the following proposal modification:  Use all ‘0’ FDRA for resourceAllocationType0 and all ‘1’ FDRA for resourceAllocationType 1 with one-shot HARQ-ACK request field with value 1 in DCI Format 1\_1 with CRC scrambled by C-RNTI and MCS-C-RNTI to signal Type-3 HARQ-ACK request without scheduling PDSCH   * + Clarify in the specifications that in this case, the UE does not consider the DCI format as indicating an active DL BWP provided by dormant-BWP or by first-non-dormant-BWP-ID-for-DCI-inside-active-time, if any, ~~and the validation for SPS release as described in Clause 10.2 is not achieved.~~   Exact TPs we can discuss next week. |
| ZTE | Technically, we still prefer to use a new DCI field in format 1\_1 to explicitly indicate whether this DCI schedules a PDSCH or not, to avoid any restriction on the validation for SPS release. But we are fine to compromise if majority thinks this is a corner case. |
| Sharp | Agree with FL’s proposal. |
| LG | Firstly, agree with Nokia for the above addition of “with CRC scrambled by C-RNTI and MCS-C-RNTI”.  Secondly, it seems necessary to discuss whether any clarification with Scell dormancy indication (i.e., do not consider the DCI format as indicating dormant BWP) is needed or not.  This is because, for example, if gNB wants to only indicate one-shot CB triggering without Scell dormancy indication, the gNB could set the values in other DCI fields (e.g. HARQ ID) as for indicating the same current BWP (even without the above clarification). |
| vivo | Agree with FL’s proposal. Any TP can be ok if this solution is addressed clearly and accurately. |
| Samsung | Agree with FL’s proposal. |
| QC | Agree in principle with the following comments:   * The case of *resourceAllocation* = *dynamicSwitch* should be also clarified (either all 0’s or all 1’s FDRA can be used) * Regarding “with CRC scrambled by C-RNTI and MCS-C-RNTI”, then how to handle the case that DCI has CRC scrambled by CS-RNTI, has reserved FDRA, and one-shot HARQ-ACK request field is set to 1? Is it error case, or UE ignores the one-shot HARQ-ACK request field?   + Note that the case that CRC is scrambled with CS-RNTI, FDRA is not reserved (not SPS release), and one-shot HARQ-ACK request field is set to 1 seem to be already supported (for the case that DCI schedules PDSCH, either SPS activation or ReTx scheduling). |
| Ericsson | Agree with FL proposal.  We can discuss TP at a later stage. Note that in proposed TPs, one-shot should be changed to Type-3 HARQ codebook. |
| Lenovo, Motorola Mobility | Agree with FL proposal.  In addition, for one-shot triggering DCI without scheduled PDSCH, we have below highlighted agreement which has not been captured yet. I am wondering whether below highlighted part can be incorporated in this TP.  Agreement:  If a UE is configured to monitor feedback request for one-shot HARQ-ACK codebook feedback and the feedback is requested in DL DCI 1\_1   * This DL DCI can either schedule or not schedule a PDSCH * Working assumption: One value of the frequency domain resource assignment field indicates that this DCI does not schedule a PDSCH * If the DL DCI does not schedule a PDSCH, the HARQ process ID and NDI fields are ignored by the UE * If UE is triggered to report both one-shot and other HARQ-ACK feedback in the same slot, the UE reports only the one-shot feedback. |
| FL summary | @Ericsson: One-shot HARQ-ACK request is the correct field name in DCI 1\_1.  @Lenovo: we can discuss whether/how to capture the agreement “If the DL DCI does not schedule a PDSCH, the HARQ process ID and NDI fields are ignored by the UE” when we discuss the TPs.  @ LG: it is not obvious which values of Modulation and coding scheme of transport block 1, New data indicator of transport block 1, Redundancy version of transport block 1, HARQ process number, Antenna port(s), [DMRS sequence initialization] would be chosen to not correspond to a valid bitmap for SCell dormancy indication, and as you said this also depends on the number of cells. It is not clear if we really need to optimize for simultaneously signaling type-3 HARQ-ACK codebook feedback and SCell dormancy.  Updated Proposal from FL:   * No new DCI field is introduced for requesting Type-3 HARQ-ACK feedback without scheduling a PDSCH * For DCI Format 1\_1 with CRC scrambled by C-RNTI or MCS-C-RNTI:   + - To signal Type-3 HARQ-ACK codebook request without scheduling PDSCH with one-shot HARQ-ACK request field with value 1 in DCI Format 1\_1 with DCI Format 1\_1 CRC scrambled by C-RNTI or MCS-C-RNTI, use all ‘0’ FDRA for resourceAllocationType0 and all ‘1’ FDRA for resourceAllocationType 1 if resourceAllocation = dynamicSwitch is not provided, or use all “0” or all “1” FDRA if resourceAllocation = dynamicSwitch is provided. In this case, the UE does not consider the DCI format as indicating an active DL BWP provided by dormant-BWP or by first-non-dormant-BWP-ID-for-DCI-inside-active-time, if any. * For DCI Format 1\_1 with CRC scrambled by CS-RNTI:   + - Alt1: to signal Type-3 HARQ-ACK codebook request without scheduling PDSCH with one-shot HARQ-ACK request field with value 1 in DCI Format 1\_1 with DCI Format 1\_1 CRC scrambled by CS-RNTI, use all ‘0’ FDRA for resourceAllocationType0 and all ‘1’ FDRA for resourceAllocationType 1 if resourceAllocation = dynamicSwitch is not provided, or use all “0” or all “1” FDRA if resourceAllocation = dynamicSwitch is provided. In this case, the validation for SPS release as described in Clause 10.2 is not achieved.     - Alt2: the UE ignores the value of one-shot HARQ-ACK request field when the DCI signals ‘0’ FDRA for resourceAllocationType0 or all ‘1’ FDRA for resourceAllocationType 1 if resourceAllocation = dynamicSwitch is not provided, or use all “0” or all “1” FDRA if resourceAllocation = dynamicSwitch is provided.   Companies please further indicate your view on the updated proposal, and on Alt1 and Alt2 for the case of DCI Format 1\_1 with CRC scrambled by CS-RNTI. |
| Intel | We are supportive to the first two main bullet of updated FL proposal  For the 3rd bullet, we prefer Alt2, i.e. the DCI is for SPS activation/release, without triggering Type3 HARQ-ACK CB |
| Nokia, NSB | We did not realize previously that in R16, DL SPS release is possible also with DCI format 1\_1, where trigger bit is present. Therefore it is OK, to support trigger also in PDSCH release for commonality with re-tx and activation as mentioned by QC, i.e. Alt1 is preferred. |
| Lenovo, Motorola Mobility | We support the first two main bullets.  Regarding the 3rd bullet, Alt 2 is preferred. |

Summary of proposals in submitted Tdocs

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| **Company** | **Summary of proposals** |
| Huawei  (R1-2001536) | Use all ‘0’ FDRA for resourceAllocationType0 and all ‘1’ FDRA for resourceAllocationType 1 with one-shot HARQ-ACK request field with value 1 in DCI Format 1\_1 to signal one-shot HARQ-ACK request without scheduling PDSCH.  In this case, the UE does not consider the DCI format as indicating an active DL BWP provided by dormant-BWP or by first-non-dormant-BWP-ID-for-DCI-inside-active-time, if any, and the validation for SPS release as described in Clause 10.2 is not achieved.  TPs provided for TS 38.212 Clause 7.3.1.2.2, TS 38.213 Clause 9.1.4, TS 38.213 Clause 10.2, TS 38.213 Clause 10.3  **TP#5 for TS 38.212 Clause 7.3.1.2.2**  =========== Unchanged part omitted ==========  If all bits of frequency domain resource assignment are set to 0 for resource allocation type 0 or set to 1 for resource allocation type 1, and One-shot HARQ-ACK request = 0, if any, this field is reserved and the following fields among the fields above are used for Scell dormany indication, where each bit corresponds to one of the configured Scell(s), with MSB to LSB of the following fields concatenated in the order below corresponding to the Scell with lowest to highest Scell index  =========== Unchanged part omitted ==========  **TP#6 for TS 38.213 Clause 9.1.4**  =========== Unchanged part omitted ==========  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clause 9.2.5.  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, and if  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 1,  The UE considers that the DCI format does not schedule PDSCH reception. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot.  =========== Unchanged part omitted ==========  **TP#7 for TS 38.213 Clause 10.2**  =========== Unchanged part omitted ==========  Table 10.2-2: Special fields for single DL SPS or single UL grant Type 2 scheduling release PDCCH validation   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | HARQ process number | set to all ‘0’s/0\_1/0\_2 | set to all ‘0’s | | Redundancy version | set to all ‘0’s | set to all ‘0’s | | Modulation and coding scheme | set to all ‘1’s | set to all ‘1’s | | Frequency domain resource assignment | set to all ‘1’s | set to all ‘0’s for FDRA Type 0 set to all ‘1’s for FDRA Type 1 | | One-shot HARQ-ACK request | - | Set to ‘0’ , if any |   Table 10.2-4: Special fields for multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | Redundancy version | set to all ‘0’s | set to all ‘0’s | | Modulation and coding scheme | set to all ‘1’s | set to all ‘1’s | | Frequency domain resource assignment | set to all ‘1’s | set to all ‘0’s for FDRA Type 0  set to all ‘1’s for FDRA Type 1 | | One-shot HARQ-ACK request | - | Set to ‘0’ , if any |   =========== Unchanged part omitted ==========  **TP#8 for TS 38.213 Clause 10.3**  =========== Unchanged part omitted ==========  If a UE is provided search space sets to monitor PDCCH for detection of DCI format 1\_1, and if  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 1, and  - One-shot HARQ-ACK request is set to 0, if any  the UE considers the DCI format 1\_1 as indicating an active DL BWP provided by *dormant-BWP* or by *first-non-dormant-BWP-ID-for-DCI-inside-active-time* for each activated Scell and interprets the sequence of fields of, for transport block 1  =========== Unchanged part omitted ========== |
| Vivo  (R1-2001654) | When UE is provided pdsch-HARQ-ACK-OneShotFeedback-r16, and a downlink DCI including a One-shot HARQ-ACK request field with value 1 is detected with FDRA field set to all ‘0’s for FDRA Type 0 and all ‘1’s for FDRA Type 1, the DCI is regarded as triggering one-shot HARQ-ACK feedback with no scheduled PDSCH |
| OPPO  (R1-2001761) | When one-shot HARQ-ACK feedback is indicated by DCI format 1\_1, one value of the frequency domain resource assignment field indicates no PDSCH transmission. |
| LG  (R1-2001937) | For example, decide to use the FRDA value consisting of all ‘0’ for RA type 0 and the FDRA value consisting of all ‘1’ for RA type 1 |
| Intel  (R1-2001989) | Confirm the working assumption and the special value triggering one-shot feedback w/o scheduled PDSCH in DCI format 1\_1 are.  • FDRA field set to all 1s when type 1 RA is used for UE  • FDRA field set to all 0s when type 0 RA is used for UE  **TP for TS38.213 section 10.3:**  If the UE detects a DCI format that includes a one-shot HARQ-ACK request field with value 1, and if a UE is provided search space sets to monitor PDCCH for detection of DCI format 1\_1, and if  - the CRC of DCI format 1\_1 is scrambled by a C-RNTI or a MCS-C-RNTI, and if  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 1  - *resourceAllocation = dynamicSwitch* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0 or 1  the UE considers the DCI format 1\_1 as indicating Scell dormancy, not scheduling a PDSCH reception or indicating a SPS PDSCH release, and for transport block 1 interprets the sequence of fields of  - modulation and coding scheme  - new data indicator  - redundancy version  and of  - HARQ process number  - antenna port(s)  - DMRS sequence initialization  as providing a bitmap to each configured Scell, in an ascending order of the Scell index, where  - a ‘0’ value for a bit of the bitmap indicates an active DL BWP, provided by *dormant-BWP*, for the UE for a corresponding activated Scell  - a ‘1’ value for a bit of the bitmap indicates  - an active DL BWP, provided by *first-non-dormant-BWP-ID-for-DCI-inside-active-time*, for the UE for a corresponding activated Scell, if a current active DL BWP is the dormant DL BWP  - a current active DL BWP, for the UE for a corresponding activated Scell, if the current active DL BWP is not the dormant DL BWP  - the UE sets the active DL BWP to the indicated active DL BWP |
| InterDigital  (R1-2002306) | One value of the frequency domain resource assignment field indicates that a DCI does not schedule a PDSCH.   * FDRA value of all “0” can be used for resource allocation type 0. * FDRA value of all “1” can be used for resource allocation type 1. |
| Nokia  (R1-2002227) | UE assumes a DCI format 1\_1 with zero RA scrambled with C/MCS-C-RNTI indicates   * dormancy if TYPE-3 CB is not triggered by the DCI format * TYPE-3 CB trigger if TYPE-3 CB is triggered by the DCI format   **TP for TS38.212:**  7.3.1.2.2 Format 1\_1  <unchanged text omitted >  - One-shot HARQ-ACK request – 0 or 1 bit.  - 1 bit if higher layer parameter *pdsch-HARQ-ACK-OneShotFeedback-r16* is configured;  - 0 bit otherwise.  - Scell dormancy indication – 0 bit if higher layer parameter *Scell-groups-for-dormancy-within-active-time* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to higher layer parameter *Scell-groups-for-dormancy-within-active-time,* where each bit corresponds to one of the Scell group(s) configured by higher layers parameter *Scell-groups-for-dormancy-within-active-time,* with MSB to LSB of the bitmap corresponding to the first to last configured Scell group. The field is only present when this format is carried by PDCCH on the primary cell within DRX Active Time and the UE is configured with at least two DL BWPs for an Scell.  If all bits of frequency domain resource assignment are set to 0 for resource allocation type 0 or set to 1 for resource allocation type 1, and One-shot HARQ-ACK request is not present or set to 0, ~~this field is reserved~~ ~~and~~ the following fields among the fields above are used for Scell dormany indication, where each bit corresponds to one of the configured Scell(s), with MSB to LSB of the following fields concatenated in the order below corresponding to the Scell with lowest to highest Scell index  - Modulation and coding scheme of transport block 1  - New data indicator of transport block 1  - Redundancy version of transport block 1  - HARQ process number  - Antenna port(s)  [- DMRS sequence initialization]  <unchanged text omitted >  **TP for TS38.213:** 10.3 PDCCH monitoring indication and dormancy/non-dormancy ehavior for Scells <unchanged text omitted >  If a UE is provided search space sets to monitor PDCCH for detection of DCI format 1\_1, and if  - the CRC of DCI format 1\_1 is scrambled by a C-RNTI or a MCS-C-RNTI, and if  - one-shot HARQ-ACK request in DCI format 1\_1 or 1\_2 is set to 0, if a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16,* and if  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 1  - *resourceAllocation = dynamicSwitch* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0 or 1  <unchanged text omitted > 9.1.4 Type-3 HARQ-ACK codebook determination If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, the UE determines a Type-3 HARQ-ACK codebook according to the following procedure.  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1 and if  - the CRC of DCI format 1\_1 is scrambled by a C-RNTI or a MCS-C-RNTI, and if  - resourceAllocation = resourceAllocationType0 and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0, or  - resourceAllocation = resourceAllocationType1 and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 1  - resourceAllocation = dynamicSwitch and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0 or 1  the UE considers the DCI format 1\_1 is not scheduling a PDSCH reception or indicating a SPS PDSCH release.  <unchanged text omitted > |
| ZTE  (R1-2001707) | Rather than using implicit indication by one value of the FDRA field, it is preferable to add a bit filed DL-SCH in the DCI format 1\_1 to explicitly indicate whether this DCI schedules a PDSCH or not |
| Samsung  (R1-2002119) | If a UE is configured to monitor feedback request for one-shot HARQ-ACK codebook and the request bit field in DL DCI 1\_1 is 1, UE assumes one-shot HARQ-ACK feedback is triggered without scheduling a PDSCH if FDRA in the DCI is all ‘0’s for FDRA Type 0 or all ‘1’s for FDRA Type 1. Adopt TP3 in the conclusion part.  **TS 38.212** 7.3.1.2.2 Format 1\_1 DCI format 1\_1 is used for the scheduling of PDSCH in one cell.  The following information is transmitted by means of the DCI format 1\_1 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:  - Identifier for DCI formats – 1 bits  - The value of this bit field is always set to 1, indicating a DL DCI format  …  - Frequency domain resource assignment – number of bits determined by the following, where  is the size of the active DL bandwidth part:  -  bits if only resource allocation type 0 is configured, where  is defined in Clause 5.1.2.2.1 of [6, TS38.214],  - bits if only resource allocation type 1 is configured, or  -  bits if both resource allocation type 0 and 1 are configured.  - If both resource allocation type 0 and 1 are configured, the MSB bit is used to indicate resource allocation type 0 or resource allocation type 1, where the bit value of 0 indicates resource allocation type 0 and the bit value of 1 indicates resource allocation type 1.  - For resource allocation type 0, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.1 of [6, TS 38.214].  - For resource allocation type 1, the  LSBs provide the resource allocation as defined in Clause 5.1.2.2.2 of [6, TS 38.214]  If “Bandwidth part indicator” field indicates a bandwidth part other than the active bandwidth part and if both resource allocation type 0 and 1 are configured for the indicated bandwidth part, the UE assumes resource allocation type 0 for the indicated bandwidth part if the bitwidth of the “Frequency domain resource assignment” field of the active bandwidth part is smaller than the bitwidth of the “Frequency domain resource assignment” field of the indicated bandwidth part.  If the value of one-shot HARQ-ACK request field is set to ‘1’, a value of all ‘0’s for resource allocation type 0, or a value all ‘1’s for resource allocation type 1 indicates DL-SCH shall not be transmitted on the PDSCH, otherwise, DL-SCH shall be transmitted on the PDSCH.  …  - Scell dormancy indication – 0 bit if higher layer parameter *Scell-groups-for-dormancy-within-active-time* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to higher layer parameter *Scell-groups-for-dormancy-within-active-time,* where each bit corresponds to one of the Scell group(s) configured by higher layers parameter *Scell-groups-for-dormancy-within-active-time,* with MSB to LSB of the bitmap corresponding to the first to last configured Scell group. The field is only present when this format is carried by PDCCH on the primary cell within DRX Active Time and the UE is configured with at least two DL BWPs for an Scell.  If one-shot HARQ-ACK request is not present or set to ‘0’, and all bits of frequency domain resource assignment are set to 0 for resource allocation type 0 or set to 1 for resource allocation type 1, this field is reserved and the following fields among the fields above are used for Scell dormany indication, where each bit corresponds to one of the configured Scell(s), with MSB to LSB of the following fields concatenated in the order below corresponding to the Scell with lowest to highest Scell index  - Modulation and coding scheme of transport block 1  - New data indicator of transport block 1  - Redundancy version of transport block 1  - HARQ process number  - Antenna port(s)  [- DMRS sequence initialization]  …  **TS 38.213** 10.2 PDCCH validation for DL SPS and UL grant Type 2 …  If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH, a value of the HARQ process number field in a DCI format indicates an activation for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *Configuredgrantconfig-index* or by *SPSconfig-index*, respectively. Validation of the DCI format is achieved if the RV field for the DCI format is set as in Table 10.2-3.  If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH  - if the UE is provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a corresponding entry for scheduling release of one or more UL grant Type 2 PUSCH or SPS PDSCH configurations  - if the UE is not provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a release for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *Configuredgrantconfig-index* or by *SPSconfig-index*, respectively  Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-4.  Table 10.2-2: Special fields for single DL SPS or single UL grant Type 2 scheduling release PDCCH validation   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | HARQ process number | set to all ‘0’s | set to all ‘0’s | | Redundancy version | set to all ‘0’s | set to all ‘0’s | | Modulation and coding scheme | set to all ‘1’s | set to all ‘1’s | | Frequency domain resource assignment | set to all ‘0’s for FDRA Type 0 or for FDRA Type 2 with ,  set to all ‘1’s for FDRA Type 1 or for FDRA Type 2 with | set to all ‘0’s for FDRA Type 0 set to all ‘1’s for FDRA Type 1 | | One-shot HARQ-ACK request (if present) | N/A | Set to ‘0’ |   …  Table 10.2-4: Special fields for multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | Redundancy version | set to all ‘0’s | set to all ‘0’s | | Modulation and coding scheme | set to all ‘1’s | set to all ‘1’s | | Frequency domain resource assignment | set to all ‘0’s for FDRA Type 0 or for FDRA Type 2 with ,  set to all ‘1’s for FDRA Type 1 or for FDRA Type 2 with | set to all ‘0’s for FDRA Type 0  set to all ‘1’s for FDRA Type 1 | | One-shot HARQ-ACK request (if present) | N/A | Set to ‘0’ | |
| Sharp  (R1-2002384) | The working assumption should be confirmed, and all zero values and all one values should be used to indicate whether the triggering DCI schedules a PDSCH for PDSCH resource allocation type 0 and type 1, respectively.  --------- beginning of text proposal for TS 38.213 9.1.4 Type-3 HARQ-ACK codebook determination […]  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clause 9.2.5. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot.  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1 and a frequency domain resource assignment field with all zeros for resource allocation type 0, or all ones for resource allocation type 1 in the DCI format, the DCI format does not schedule a PDSCH.  […] 12 Bandwidth part operation […]  If a bandwidth part indicator field is configured in DCI format 1\_1, the bandwidth part indicator field value indicates the active DL BWP, from the configured DL BWP set, for DL receptions as described in [5, TS 38.212]. If a bandwidth part indicator field is configured in DCI format 0\_1, the bandwidth part indicator field value indicates the active UL BWP, from the configured UL BWP set, for UL transmissions as described in [5, TS 38.212]. If a bandwidth part indicator field is configured in DCI format 0\_1 or DCI format 1\_1 and indicates an UL BWP or a DL BWP different from the active UL BWP or DL BWP, respectively, the UE shall  - for each information field in the received DCI format 0\_1 or DCI format 1\_1  - if the size of the information field is smaller than the one required for the DCI format 0\_1 or DCI format 1\_1 interpretation for the UL BWP or DL BWP that is indicated by the bandwidth part indicator, respectively, the UE prepends zeros to the information field until its size is the one required for the interpretation of the information field for the UL BWP or DL BWP prior to interpreting the DCI format 0\_1 or DCI format 1\_1 information fields, respectively  - if the size of the information field is larger than the one required for the DCI format 0\_1 or DCI format 1\_1 interpretation for the UL BWP or DL BWP that is indicated by the bandwidth part indicator, respectively, the UE uses a number of least significant bits of DCI format 0\_1 or DCI format 1\_1 equal to the one required for the UL BWP or DL BWP indicated by bandwidth part indicator prior to interpreting the DCI format 0\_1 or DCI format 1\_1 information fields, respectively  - set the active UL BWP or DL BWP to the UL BWP or DL BWP indicated by the bandwidth part indicator in the DCI format 0\_1 or DCI format 1\_1, respectively  A UE is not expected to receive the DCI format 1\_1 in which the One-shot HARQ-ACK request field is set to 1, and the size of frequency domain resource assignment field is different from the one required for the DCI format 1\_1 interpretation for the DL BWP that is indicated by the bandwidth part indicator.  --------- end of text proposal |
| Qualcomm  (R1-2002532) | Use all ‘0’ FDRA for resourceAllocationType0 and all ‘1’ FDRA for resourceAllocationType 1 for one-shot HARQ-ACK request without scheduling PDSCH.  TP for 38.213 Section 9.1.4  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, and if  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in DCI format are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* or *dynamicSwitch* and all bits of the frequency domain resource assignment field in DCI format are equal to 1  the DCI format does not schedule PDSCH and only requests Type-3 HARQ-Ack codebook, and the UE does not consider the DCI format as indicating an active DL BWP provided by *dormant-BWP* or by *first-non-dormant-BWP-ID-for-DCI-inside-active-time*, if any, and the validation for SPS release as described in Clause 10.2 is not achieved. |

#### Issue 2 (reference timing)

5 companies proposed to take the slot where the PDCCH/DCI is transmitted/received as a reference for K1. Only 1 company proposed that the starting point of K1 value should be determined based on the TDRA in the trigger DCI.

Proposal from FL: take the majority proposal

* The slot where the PDCCH/DCI is transmitted/received is taken as a reference for K1
* Corresponding TP for TS 38.213 Clause 9.2.3 to be developed as follows (with reference to 38.213 clause 9.1.4 or 38.212 clause 7.3.1.2.2 depending on B1 issue 1)

**TP for TS 38.213 Clause 9.2.3**

================== Beginning of text proposal ===================

**9.2.3 UE procedure for reporting HARQ-ACK**

--Unchanged part omitted------------------------

With reference to slots for PUCCH transmissions, if the UE detects a DCI format scheduling a PDSCH reception ending in slot  or if the UE detects a DCI format indicating a SPS PDSCH release through a PDCCH reception ending in slot *n*, or if the UE detects a DCI format that does not schedule PDSCH and only requests Type-3 HARQ-Ack codebook as described in Clause 9.1.4 through a PDCCH reception ending in slot *n*, the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot , where  is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, or by *dl-DataToUL-ACKForDCIFormat1\_2* for DCI format 1\_2.  corresponds to the last slot of the PUCCH transmission that overlaps with the PDSCH reception or with the PDCCH reception in case of SPS PDSCH release or in case of requesting Type-3 HARQ-Ack without scheduling a PDSCH.

--Unchanged part omitted------------------------

================== End of text proposal ===================

Please complete/revise/add your company’s view on the proposal in the table below.

|  |  |
| --- | --- |
| **Company** | **Comments on FL proposal** |
| OPPO | We think it is not needed to restrict to non-scheduled PDSCH, the reason is that in 9.1.4, it explicit mentions ‘if the UE has obtained HARQ-ACK information of the TB….’, in this case, even though for a DCI format scheduling PDSCH, the timing definition can still be aligned with without PDSCH scheduling case. For this reason, we propose  or if the UE detects a DCI format that requests Type-3 HARQ-Ack codebook as described in Clause 9.1.4 through a PDCCH reception ending in slot *n*,  The advantage is that the timing definition is aligned for DCI scheduling PDSCH and not scheduling PDSCH. |
| Nokia, NSB | FL proposal to follow DL SPS framework (including TP) sounds very reasonable to us. |
| ZTE | We support the FL proposal |
| Sharp | We are fine with FL’s proposal. |
| LG | Seems to be OK. |
| vivo | Ok with FL’s proposal. |
| Samsung | Agree with FL’s proposal. |
| QC | Agree with FL’s proposal. Suggested text from OPPO leads to problems and is unnecessary, e.g. what is timing for HARQ-Ack for the scheduled PDSCH (since the DCI both schedules PDSCH and requests one-shot HARQ-Ack)? If it is the same, then reference for K1 is different from reference for N1 (PDSCH processing time). |
| Ericsson | We are fine with FL suggestion. |
| Lenovo, Motorola Mobility | Agree with FL proposal |
| FL summary | There seem to be consensus for the case where no PDSCH is scheduled (the proposed TP), and no consensus to change the rule for the case where PDSCH is scheduled. Note that the scope of the discussion is only for the case where PDSCH is not scheduled when Type-3 codebook feedback is requested.  If no further comment is provided (focusing on case where PDSCH is not scheduled) then the proposal will be considered stable (with TBD on the clause reference). |
| Intel | Agree with the updated FL proposal |
| Lenovo, Motorola Mobility | Agree with the updated FL proposal |

Summary of proposals in submitted Tdocs

|  |  |
| --- | --- |
| **Company** | **Summary of proposals** |
| Huawei  (R1-2001536) | The PDCCH reception ending slot should be considered as the reference for PUCCH transmission  **TP#9 for TS 38.213 Clause 9.2.3**  ============= Unchanged part omitted ============  With reference to slots for PUCCH transmissions, if the UE detects a DCI format scheduling a PDSCH reception ending in slot  or if the UE detects a DCI format indicating a SPS PDSCH release through a PDCCH reception ending in slot  or if the UE detects a DCI format indicating *One-shot HARQ-ACK request* with value 1 without scheduling PDSCH through a PDCCH reception ending in slot  , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot , where  is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, or by *dl-DataToUL-ACKForDCIFormat1\_2* for DCI format 1\_2.  corresponds to the last slot of the PUCCH transmission that overlaps with the PDSCH reception or with the PDCCH reception in case of SPS PDSCH release.  ============= Unchanged part omitted ============ |
| ZTE  (R1-2001707) | The timing K1 can be counted from the slot that the PDCCH transmitted |
| OPPO  (R1-2001761) | -------------------------Start of TP3 38.213 V16.1.0 section 9.2.3 ------------  9.2.3 UE procedure for reporting HARQ-ACK  <Unchanged parts are omitted>  With reference to slots for PUCCH transmissions, if the UE detects a DCI format scheduling a PDSCH reception ending in slot , if the UE detects a DCI format indicating a SPS PDSCH release through a PDCCH reception ending in slot , or if the UE detects a DCI format including a One-shot HARQ-ACK request field with value 1 through a PDCCH reception ending in slot , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot , where  is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, or by *dl-DataToUL-ACKForDCIFormat1\_2* for DCI format 1\_2.  corresponds to the last slot of the PUCCH transmission that overlaps with the PDSCH reception or with the PDCCH reception in case of SPS PDSCH release.  -----------------End of TP3 38.213 V16.1.0 section 9.2.3 --------------------- |
| LG  (R1-2001937) | For example, decide to set the reference slot as the slot with the DCI transmission or the slot corresponding to the TDRA value indicated in the DCI |
| InterDigital  (R1-2002306) | In case the DCI triggering Type-3 HARQ-ACK codebook transmission is not scheduling a PDSCH, the reference slot for K1 indication is the slot on which the DCI is received |
| Samsung  (R1-2002119) | For a DCI request one-shot HARQ-ACK feedback without PDSCH, the slot overlapping with the PDCCH ending symbols is the reference for K1=0.  **TS 38.213**  **9.2.3 UE procedure for reporting HARQ-ACK**  ..  With reference to slots for PUCCH transmissions, if the UE detects a DCI format scheduling a PDSCH reception ending in slot  or if the UE detects a DCI format indicating a SPS PDSCH release through a PDCCH reception ending in slot , or if the UE detects a DCI format that requests Type-3 HARQ-ACK codebook without scheduling a PDSCH as described in Clause 9.1.4 through a PDCCH reception ending in slot , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot , where  is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, or by *dl-DataToUL-ACKForDCIFormat1\_2* for DCI format 1\_2.  corresponds to the last slot of the PUCCH transmission that overlaps with the PDSCH reception or with the PDCCH reception in case of SPS PDSCH release or Type-3 HARQ-ACK codebook request without scheduling a PDSCH. |
| Sharp  (R1-2002384) | The starting point of K1 value should be determined based on the TDRA in the trigger DCI  --------- beginning of text proposal for TS 38.213 9.2.3 UE procedure for reporting HARQ-ACK […]  With reference to slots for PUCCH transmissions, if the UE detects a DCI format scheduling a PDSCH reception ending in slot  or if the UE detects a DCI format indicating a SPS PDSCH release through a PDCCH reception ending in slot  or if the UE detects a DCI format triggering Type-3 HARQ-ACK codebook without scheduling PDSCH and the time domain resource assignment field value in the DCI indicates a PDSCH ending in slot , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot , where  is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, or by *dl-DataToUL-ACKForDCIFormat1\_2* for DCI format 1\_2.  corresponds to the last slot of the PUCCH transmission that overlaps with the PDSCH reception or with the PDCCH reception in case of SPS PDSCH release.  --------- end of text proposal |
| Qualcomm  (R1-2002532) | For a DCI request one-shot HARQ-ACK feedback, K1 is counted from the slot the DCI is transmitted  ============TP for 38.213 Section 9.2.3========  --Unchanged part omitted------------------------  With reference to slots for PUCCH transmissions, if the UE detects a DCI format scheduling a PDSCH reception ending in slot  or if the UE detects a DCI format indicating a SPS PDSCH release through a PDCCH reception ending in slot *n*, or if the UE detects a DCI format that does not schedule PDSCH and only requests Type-3 HARQ-Ack codebook as described in Clause 9.1.4 through a PDCCH reception ending in slot *n*, the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot , where  is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, or by *dl-DataToUL-ACKForDCIFormat1\_2* for DCI format 1\_2.  corresponds to the last slot of the PUCCH transmission that overlaps with the PDSCH reception or with the PDCCH reception in case of SPS PDSCH release or in case of requesting Type-3 HARQ-Ack without scheduling a PDSCH.  --Unchanged part omitted------------------------ |

#### Issue 3 (processing time)

Issue 3: whether/how to determine the UE processing time applied for the one-shot HARQ-ACK feedback triggered by the PDSCH-less DCI.

Proposal from FL:

* For a DCI requesting one-shot HARQ-ACK feedback without scheduling PDSCH, reuse the minimum processing latency for SPS release DCI
* Corresponding TP for TS 38.213 Clause 9.1.4 to be developed as follows

**TP for TS 38.213 Clause 9.1.4**

================== Beginning of text proposal ===================

**9.1.4 Type-3 HARQ-ACK codebook determination**

--Unchanged part omitted------------------------

A UE is expected to provide HARQ-ACK information in response to a type-3 HARQ-ACK codebook request without scheduling PDSCH after  symbols from the last symbol of a PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH. If *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell with the PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH,  for ,  for , and  for , otherwise,  for ,  for ,  for , and  for , wherein  corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH and the SCS configuration of a PUCCH carrying the HARQ-ACK information in response to a type-3 HARQ-ACK codebook request without scheduling PDSCH.

--Unchanged part omitted------------------------

================== End of text proposal ===================

Please complete/revise/add your company’s view on the proposal in the table below.

|  |  |
| --- | --- |
| **Company** | **Comments on FL proposal** |
| OPPO | Agree with the TP proposed by FL |
| Nokia, NSB | FL proposal to follow DL SPS framework (including TP) sounds very reasonable to us. |
| ZTE | Agree to reuse the minimum processing latency for SPS release DCI. One minor comment on the TP, we can remove “and  for ”. |
| Sharp | Fine with FL’s TP. However, we have a concern that whether the processing time required by running the Type-3 pseudocode with many loops should be counted. |
| LG | Seems to be OK. |
| vivo | Agree with the TP proposed by FL |
| Samsung | Agree with FL’s proposal. |
| QC | Fine with the proposal. |
| Ericsson | Fine with the proposal. |
| Lenovo, Motorola Mobility | We have concern on reusing minimum processing delay for SPS release DCI.  For SPS release DCI, a single HARQ-ACK information bit is generated and transmitted on PUCCH.  For one-shot triggering DCI, the Type 3 HARQ-ACK codebook includes HARQ-ACK information bits for all the HARQ processes on all the configured carriers especially when NDI is configured in the Type 3 HARQ-ACK codebook.  We are not pretty sure whether reusing SPS release DCI processing delay is appropriate for one-shot triggering DCI. |
| FL summary | The TP seems to be generally agreeable by companies, implying that the processing time for DL SPS is considered sufficient for Type-3 codebook generation.  A remaining discussion point is about whether to specify the processing time in case of 120 kHz SCS (which is not supported for NR-U). Companies are invited to further comment on this aspect and whether we can exclude this case as proposed by ZTE.  **TP for TS 38.213 Clause 9.1.4**  ================== Beginning of text proposal ===================  **9.1.4 Type-3 HARQ-ACK codebook determination**  --Unchanged part omitted------------------------  A UE is expected to provide HARQ-ACK information in response to a type-3 HARQ-ACK codebook request without scheduling PDSCH after  symbols from the last symbol of a PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH. If *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell with the PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH,  for ,  for , and  for , otherwise,  for ,  for ,  for , [and  for ], wherein  corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH and the SCS configuration of a PUCCH carrying the HARQ-ACK information in response to a type-3 HARQ-ACK codebook request without scheduling PDSCH.  --Unchanged part omitted------------------------  ================== End of text proposal =================== |
| Intel | Agree with the updated FL proposal |
| Nokia, NSB | OK to cover also FR2 |
| Lenovo, Motorola Mobility | Although we are still not sure about whether the processing time for DL SPS release is sufficient for Type-3 codebook generation, we are fine with the updated FL proposal.  Regarding 120kHz SCS, we support to exclude it from spec since NR-U scope doesn’t include FR2. |

Summary of proposals in submitted Tdocs

|  |  |
| --- | --- |
| **Company** | **Summary of proposals** |
| ZTE (R1-2001707) | The UE processing time for SPS PDSCH release can be reused for the one-shot HARQ-ACK feedback triggered by the PDSCH-less DCI. |
| OPPO  (R1-2001761) | *Proposal 14: Reuse the processing time of a SPS PDSCH release for the case that a DL DCI triggers one-shot HARQ-ACK feedback without scheduling a PDSCH.*  ------------------- Start of TP5 38.213 V16.1.0 section 9.1.4 ---------------  9.1.4 Type-3 HARQ-ACK codebook determination  <Unchanged parts are omitted>  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clause 9.2.5. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot.  A UE is expected to provide a Type-3 HARQ-ACK codebook in response to a DCI that includes a One-shot HARQ-ACK request field with value 1 and not schedule a PDSCH after  symbols from the last symbol of a PDCCH providing the DCI. For UE processing capability 1 [TS 38.214] and for the SCS of the PDCCH reception,  for 15kHz,  for 30kHz,  for 60kHz, and  for 120 kHz. For a UE with capability 2 [TS 38.214] and for the SCS of the PDCCH reception,  for 15 kHz,  for 30 kHz, and  for 60 kHz.  ------------------End of TP5 38.213 V16.1.0 section 9.1.4 -------------------- |
| Samsung (R1-2002119) | For a DCI request one-shot HARQ-ACK feedback without PDSCH, reuse the minimum processing latency for SPS release DCI.  **TS 38.213**  **9.1.4 Type-3 HARQ-ACK codebook determination**  …  A UE is expected to provide HARQ-ACK information in response to a type-3 HARQ-ACK codebook request without scheduling PDSCH after  symbols from the last symbol of a PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH. If *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell with the PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH,  for ,  for , and  for , otherwise,  for ,  for ,  for , and  for , wherein  corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH and the SCS configuration of a PUCCH carrying the HARQ-ACK information in response to a type-3 HARQ-ACK codebook request without scheduling PDSCH. |
| LG (R1-2001937) | Decide which of the existing UE processing time (e.g., N1 for PDSCH, N2 for PUSCH, N for SPS release) is used as the reference for this case |

## Issue B9

|  |  |
| --- | --- |
| B9 | Clarification that Type-3 HARQ-ACK codebook feedback should be generated for all configured serving cells |

FL Proposal:

* TP for TS 38.213 Clause 9.1.4
  + Reason for change: missing implementation of agreement that the UE reports HARQ-ACK information for all configured serving cells in Type-3 HARQ-ACK codebook, otherwise a UE may only report HARQ-ACK information for activated serving cells with ambiguity during cell activation/deactivation periods.

**TP for TS 38.213 Clause 9.1.4**

================== Beginning of text proposal ===================

**9.1.4 Type-3 HARQ-ACK codebook determination**

If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, the UE determines a Type-3 HARQ-ACK codebook according to the following procedure.

Set to the number of serving cells configured to the UE.

================== End of text proposal ===================

Please complete/revise/add your company’s view on the proposal in the table below.

|  |  |
| --- | --- |
| **Company** | **Comments on FL proposal** |
| OPPO | We are fine with the TP proposed by FL, although we think the change is not essential because we think the definition at the beginning of clause 9 is pretty clear already. |
| Nokia, NSB | Agree with the TP |
| ZTE | Agree with the TP |
| Sharp | Agree with FL’s TP. |
| LG | Seems to be OK. |
| vivo | Agree with FL’s TP. |
| Samsung | Agree with FL’s proposal. |
| ETRI | We tend to agree with the proposal, however we still think that we need additional clarification, not to flush HARQ-ACK bits during the Scell change. This is because the NNK in the unlicensed band and some Scell may have unreported HARQ-ACK bits with the timer expiration and/or Scell change. We also think this scenario is different from the type 1 HARQ codebook operating in the licensed band.  With the feature lead’s minimal text, in our understanding, whether HARQ-ACK is reported as NACK or HARQ-ACK is not clear. We would like to see more views from other companies. |
| QC | Agree with FL’s proposal. |
| Ericsson | Agree with FL’s proposal. |
| Lenovo, Motorola Mobility | Agree with FL proposal. |
| FL summary | All companies agree with the proposed TP. It is still only the view of a single company that an exception such as for CSI would be needed for Type-3 HARQ codebook in case of Scell de-activation. Other companies are invited to further comment on this point. |
| Intel | Agree with the FL proposal |
| Lenovo, Motorola Mobility | Agree with the FL proposal. |

Summary of proposals in submitted Tdocs

|  |  |
| --- | --- |
| **Company** | **Summary of proposals** |
| ETRI | Type-3 codebook status in relation to SCell deactivation:the deactivation/activation of an SCell may be valid after slot *n+ k* ifthe MAC CE is received in slot *n* or the timer expires in slot *n*. Thus, the UE behaviour for generating Type-3 HARQ codebook during the slot *n* and the slot *n+k* is not clearly defined in the TS 38.321. This is because HARQ buffer is flushed during the period according to the TS 38.321.  Proposal from R1-2002249: Clarify the timing for Type-3 HARQ codebook when an SCell is being deactivated, and consider the proposed texts below.   |  | | --- | | TS 38.213-g10 section 4.5  … With reference to slots for PUCCH transmissions, if a UE receives a deactivation command [11, TS 38.321] for a secondary cell ending in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting and Type-3 HARQ-ACK codebook generation on an activated serving cell which the UE applies in slot *.*  If the *sCellDeactivationTimer* associated with the secondary cell expires in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting and Type-3 HARQ-ACK codebook generation on an activated serving cell which the UE applies in the first slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell. | |
| Nokia | TYPE-1 CB explicitly mentions configured serving cells. TYPE-2 CB has no issue with Scell activation, because during Scell activation, there is no scheduling, and therefore during transient CC CB size is zero bit, no difference. TYPE-3 could work same was TYPE-1 CB, but for that spec change is needed, saying “configured serving cells” |
| Qualcomm | The change needed seems to be a minor editorial one. Agreement already mentions configured CC:  Agreement:  Support requesting feedback of a HARQ-ACK codebook containing all DL HARQ processes (one-shot feedback) for all CCs configured for a UE in the PUCCH group. |

## Issue B10

|  |  |
| --- | --- |
| B10 | Clarification to remove unintended limitations on Type-3 HARQ-ACK codebook usage (when no NNK1 value was received, when the UE is configured with semi-static codebook)  Note: issue B10 is not about discussing whether to allow HARQ-ACK bits reporting in semi-static codebook for a PDSCH scheduled with NNK1 value, because this was discussed in WI phase and not agreed. |

FL analysis: the intended behavior, which seems to be the common understanding, is that type-3 CB can be triggered when no DCI indicate a NNK1 value, and type-3 CB can be used to report PDSCH scheduled with NNK1 when UE is configured with type-1 CB. Discussion is needed to ensure the specification do not indeed unintentionally restrict this intended behavior. A TP revised from R1-2002690 is proposed below.

FL Proposal:

* TP for TS 38.213
  + Reason for change: specifications preclude that type-3 HARQ-ACK codebook can be triggered when no DCI indicate a NNK1 value, and that type-3 HARQ-ACK codebook can be used to report PDSCH scheduled with NNK1 when UE is configured with type-1 HARQ-ACK codebook, which is contradicting NR-U WI agreements.

--------------------------------- Start of Text Proposal for TS 38.213 ---------------------------------------

**9.1 HARQ-ACK codebook determination**

If a UE is provided *pdsch-HARQ-ACK-Codebook-*List, the UE can be indicated by *pdsch-HARQ-ACK-Codebook-List* to generate one or two HARQ-ACK codebooks. If the UE is indicated to generate two HARQ-ACK codebooks

- a first HARQ-ACK codebook is associated with a PUCCH of priority index 0 and a second HARQ-ACK codebook is associated with a PUCCH of priority index 1

- the UE is provided first and second for each of {*PUCCH-Config*, *UCI-OnPUSCH*, *PDSCH*-*codeBlockGroupTransmission*} by {*PUCCHConfigurationList*, *UCI-OnPUSCH-List*, *PDSCH-CodeBlockGroupTransmission-List*}, respectively, for use with the first and second HARQ-ACK codebooks, respectively

If a UE receives a PDSCH without receiving a corresponding PDCCH, or if the UE receives a PDCCH indicating a SPS PDSCH release, the UE generates one corresponding HARQ-ACK information bit. If the UE generates two HARQ-ACK codebooks, the UE is indicated by *harq-CodebookID*, per SPS PDSCH configuration, a HARQ-ACK codebook index for multiplexing the corresponding HARQ-ACK information bit.

If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that includes a One-shot HARQ-ACK request field with value 1 and a value of a PDSCH-to-HARQ\_feedback timing indicator field, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Subclause 9.1.4.

\*\*\* Unchanged text is omitted \*\*\*

**9.1.2 Type-1 HARQ-ACK codebook determination**

This clause applies if the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*.

A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ-ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1.

If a UE receives a first PDSCH scheduled by a first DCI format that the UE detects in a first PDCCH monitoring occasion and includes a PDSCH-to-HARQ\_feedback timing indicator field providing an inapplicable value from *dl-DataToUL-ACK*,

- if the UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16* andif the UE detects a second DCI format in any PDCCH monitoring occasion after the first one where the second DCI format includes a One-shot HARQ-ACK request field with value 1, the UE multiplexes the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission in a slot that is indicated by the value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format. The UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Clause 9.1.4,

- otherwise, the UE does not multiplex the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission.

--------------------------------- End of Text Proposal for TS 38.213 ------------------------------------

Please complete/revise/add your company’s view on the proposal in the table below.

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| --- | --- |
| **Company** | **Comments on FL proposal** |
| OPPO | The proposed TP aims to clarify two things.  Clarification 1: when a type1-CB UE is scheduled a PDSCH with NNK1, the HARQ-ACK information of the PDSCH is not reported in type1-CB.  Clarification 2: when a type1-CB UE is scheduled a PDSCH with NNK1, the HARQ-ACK information of the PDSCH is reported in type 3-CB, if the UE is triggered by one-shot.  **Our view is that the TP is not needed because these two clarifications are already covered by the current specifications.**  For clarification 1，the clause 9.1.2 (quote below) specifies that only the HARQ-ACK information for PDSCH with numerical K1 is reported in type 1-CB. Thus the TP text ‘otherwise, the UE does not multiplex the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission.’ has already been covered by clause 9.1.2.   |  | | --- | | 9.1.2 Type-1 HARQ-ACK codebook determination  This clause applies if the UE is configured with pdsch-HARQ-ACK-Codebook = semi-static.  A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-toHARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. |     For clarification 2, the clause 9.1.4 (quote below) specifies that if a UE detects a one-shot triggering DCI format, the UE will report type-3 CB in the PUCCH or PUSCH. Moreover, type-3 CB generation only check if the HARQ-ACK information for a TB is reported or if the UE has obtained the HARQ-ACK information for a TB. The type 3-CB generation is independent of whether the PDSCH is scheduled with NNK1 or NK1. Therefore, the clarification 2 has already been covered by clause 9.1.4.   |  | | --- | | \*\*\* Unrelated text is omitted \*\*\*  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell  end if  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception  while  \*\*\* Unrelated text is omitted \*\*\*  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clause 9.2.5. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot. |   With the above reasons, we don't support the proposed TP. |
| Nokia, NSB | No TP is needed for 9.1. in our opinion, because 9.1.4 applies to any configured CB. For NN-K1 + TYPE1 CB, it can be clarified what UE should do with respect to “second DCI format”, we support TP for 9.1.2 above. |
| ZTE | Agree with FL proposal |
| Sharp | Fine with FL’s TP.  We think it is necessary to have the TP in 9.1 to handle the case that Type-1/Type-2 and Type-3 HARQ-ACK feedbacks are indicated to report in a same slot, where Type-3 HARQ-ACK feedback should be reported. |
| LG | Seems to be OK. |
| vivo | Agree with FL’s proposal. |
| Samsung | Agree with OPPO and Nokia that no TP is needed considering the current spec already covers the case. |
| QC | It is Ok to capture both TPs. The second one seems to be more necessary than the first one. |
| Lenovo, Motorola Mobility | Agree with OPPO, Nokia and Samsung that no TP is necessary since current spec is clear. |
| FL summary | 5 (or 6) companies agree with the TPs, 3 companies think TPs are not needed.  OPPO provided a clarification based on the interpretation that 9.1.4 defines a procedure independently of whether K1 is numerical or non-numerical, which seems to be a correct interpretation. 2 companies consider that the TP for section 9.1.2 may still be necessary because a similar TP was agreed for section 9.1.3 so ambiguity would remain without a TP for 9.1.2 with respect to the second DCI format.  Continue discussion only on the TP for 9.1.2 |
| Intel | We also think no TP is needed for section 9.1. The TP for section 9.1.2 is fine |
| OPPO | TP for 9.1.2 is not needed. The TP says 1) HARQ-ACK information of PDSCH with NNK1 is not reported in Type 1 CB—which is already the case by 9.1.2  A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-toHARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1.  2) HARQ-ACK information of PDSCH with NNK1 is reported in Type 3 CB—which is the case already in 9.1.4, the HARQ-ACK information of PDSCH with NNK1 will be reported in type 3 CB as the UE has not reported the HARQ-ACK information.  We don’t see what other clarification the proposed TP can additionally provide. |
| Lenovo, Motorola Mobility | Agree with OPPO. |

Summary of proposals in submitted Tdocs

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| **Company** | **Summary of proposals** |
| Ericsson | We are aware of the paragraph cited at the end of 9.1.3.3. But this paragraph is intended to describe that after the codebook is generated, on which channel to be multiplexed and transmitted (PUCCH or PUSCH with references to 9.2.3 and 9.2.5, respectively). The issue is that when UE detects in DCI one-shot is triggered, it has to know that it should follow the procedures in 9.1.3.3 to generate the codebook. The only case in the current spec is that when DCI with NNK1 followed by DCI triggering one shot. The fix is straightforward. But if that is not done, it means that there is no support for one-shot except for the case mentioned above. Therefore, it is simple, but critical. And for this reason, we would like this issue to be considered.  Proposal 4 from R1-2002690:   |  | | --- | | --------------------------------- Start of Text Proposal 4 for TS 38.213 --------------------------------------- 9.1 HARQ-ACK codebook determination If a UE is provided *pdsch-HARQ-ACK-Codebook-*List, the UE can be indicated by *pdsch-HARQ-ACK-Codebook-List* to generate one or two HARQ-ACK codebooks. If the UE is indicated to generate two HARQ-ACK codebooks  - a first HARQ-ACK codebook is associated with a PUCCH of priority index 0 and a second HARQ-ACK codebook is associated with a PUCCH of priority index 1  - the UE is provided first and second for each of {*PUCCH-Config*, *UCI-OnPUSCH*, *PDSCH*-*codeBlockGroupTransmission*} by {*PUCCHConfigurationList*, *UCI-OnPUSCH-List*, *PDSCH-CodeBlockGroupTransmission-List*}, respectively, for use with the first and second HARQ-ACK codebooks, respectively  If a UE receives a PDSCH without receiving a corresponding PDCCH, or if the UE receives a PDCCH indicating a SPS PDSCH release, the UE generates one corresponding HARQ-ACK information bit. If the UE generates two HARQ-ACK codebooks, the UE is indicated by *harq-CodebookID*, per SPS PDSCH configuration, a HARQ-ACK codebook index for multiplexing the corresponding HARQ-ACK information bit.  If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that includes a One-shot HARQ-ACK request field with value 1, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Subclause 9.1.4. \*\*\* Unchanged text is omitted \*\*\* --------------------------------- End of Text Proposal 4 for TS 38.213 --------------------------------------- |   Proposal 6 from R1-2002690:   |  | | --- | | --------------------------------- Start of Text Proposal 6 for TS 38.213 ---------------------------------------  9.1.2 Type-1 HARQ-ACK codebook determination  This clause applies if the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*.  A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ-ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1.  If a UE receives a first PDSCH scheduled by a first DCI format that the UE detects in a first PDCCH monitoring occasion and includes a PDSCH-to-HARQ\_feedback timing indicator field providing an inapplicable value from *dl-DataToUL-ACK*,  - if the UE detects a second DCI format, the UE multiplexes the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission in a slot that is indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format, where  - if the UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one, and the second DCI format includes a One-shot HARQ-ACK request field with value 1, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Clause 9.1.4.  - otherwise, the UE does not multiplex the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission. \*\*\* Unchanged text is omitted \*\*\* --------------------------------- End of Text Proposal 6 for TS 38.213 --------------------------------------- | |
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Proposal 4 from R1-2002690:

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| --------------------------------- Start of Text Proposal 4 for TS 38.213 --------------------------------------- 9.1 HARQ-ACK codebook determination If a UE is provided *pdsch-HARQ-ACK-Codebook-*List, the UE can be indicated by *pdsch-HARQ-ACK-Codebook-List* to generate one or two HARQ-ACK codebooks. If the UE is indicated to generate two HARQ-ACK codebooks  - a first HARQ-ACK codebook is associated with a PUCCH of priority index 0 and a second HARQ-ACK codebook is associated with a PUCCH of priority index 1  - the UE is provided first and second for each of {*PUCCH-Config*, *UCI-OnPUSCH*, *PDSCH*-*codeBlockGroupTransmission*} by {*PUCCHConfigurationList*, *UCI-OnPUSCH-List*, *PDSCH-CodeBlockGroupTransmission-List*}, respectively, for use with the first and second HARQ-ACK codebooks, respectively  If a UE receives a PDSCH without receiving a corresponding PDCCH, or if the UE receives a PDCCH indicating a SPS PDSCH release, the UE generates one corresponding HARQ-ACK information bit. If the UE generates two HARQ-ACK codebooks, the UE is indicated by *harq-CodebookID*, per SPS PDSCH configuration, a HARQ-ACK codebook index for multiplexing the corresponding HARQ-ACK information bit.  If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that includes a One-shot HARQ-ACK request field with value 1, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Subclause 9.1.4. \*\*\* Unchanged text is omitted \*\*\* --------------------------------- End of Text Proposal 4 for TS 38.213 --------------------------------------- |

Proposal 6 from R1-2002690:

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| --------------------------------- Start of Text Proposal 6 for TS 38.213 ---------------------------------------  9.1.2 Type-1 HARQ-ACK codebook determination  This clause applies if the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*.  A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ-ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1.  If a UE receives a first PDSCH scheduled by a first DCI format that the UE detects in a first PDCCH monitoring occasion and includes a PDSCH-to-HARQ\_feedback timing indicator field providing an inapplicable value from *dl-DataToUL-ACK*,  - if the UE detects a second DCI format, the UE multiplexes the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission in a slot that is indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format, where  - if the UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one, and the second DCI format includes a One-shot HARQ-ACK request field with value 1, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Clause 9.1.4.  - otherwise, the UE does not multiplex the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission. \*\*\* Unchanged text is omitted \*\*\* --------------------------------- End of Text Proposal 6 for TS 38.213 --------------------------------------- |

# Conclusions

# References

1. R1-2001268 Feature lead summary#1 on NR-U phase 2 email discussion 100e-NR-unlic-NRU-HARQandULscheduling-02 (Type-3 HARQ-ACK codebook)
2. R1-2001269 Feature lead summary#1 on NR-U phase 2 email discussion 100e-NR-unlic-NRU-HARQandULscheduling-01 (enhanced Type-2 HARQ-ACK codebook)
3. R1-2001270 Feature lead summary of email discussion 100e-NR-unlic-NRU-HARQandULscheduling-03 (multi-PUSCH scheduling with DCI 0\_1)
4. R1-2002696 Feature lead summary#1 on NR-U HARQ, RAN1#100b-e
5. R1-2001536 Maintainance on HARQ-ACK enhancement Huawei, HiSilicon
6. R1-2001654 Remaining issues on HARQ operation for NR-U vivo
7. R1-2001707 Remaining issues on the HARQ for NR-U ZTE, Sanechips
8. R1-2001761 Discussion on the remaining issues of HARQ enhancements OPPO
9. R1-2001904 Remaining issues on HARQ operation for NR-U MediaTek Inc.
10. R1-2001937 Remaining issues of HARQ procedure for NR-U LG Electronics
11. R1-2001974 Remaining issues for HARQ enhancement for NR-U Lenovo, Motorola Mobility
12. R1-2001989 Enhancements to HARQ for NR-unlicensed Intel Corporation
13. R1-2002690 HARQ enhancement Ericsson
14. R1-2002119 HARQ enhancement for NR-U Samsung
15. R1-2002227 Remaining issues on NR-U HARQ scheduling and feedback Nokia, Nokia Shanghai Bell
16. R1-2002249 HARQ enhancement ETRI
17. R1-2002306 One shot HARQ ACK feedback InterDigital, Inc.
18. R1-2002384 Remaining issues and corrections on HARQ enhancement for NR-U Sharp
19. R1-2002532 TP for Enhancements to Scheduling and HARQ Operation for NR-U Qualcomm Incorporated
20. R1-2002631 Text proposal for enhanced dynamic HARQ procedures Google Inc.