**3GPP TSG-RAN WG1 Meeting #115R1-2311xxx**

**Chicago, USA, November 13th – November 17th, 2023**

**Agenda Item: 8.13.3**

**Source: Moderator (Lenovo)**

**Title: FLS#1 on disabling of HARQ feedback for IoT NTN**

**Document for: Discussion and decision**

# Introduction

In the RAN#94 plenary meeting, an enhancement work item for Rel.18 IoT NTN was approved. One of the objectives is to specify the following HARQ enhancements to IoT NTN.

*This work considers Rel-17 IoT-NTN as baseline as well as Rel-17 NR-NTN outcome and the further IoT-NTN performance enhancements objectives are listed below:*

*-* ***Disabling of HARQ feedback to mitigate impact of HARQ stalling on UE data rates [RAN1,RAN2]***

*- Study and specify, if needed, improved GNSS operations for a new position fix for UE pre-compensation during long connection times and for reduced power consumption [RAN1]*

The following agreements on disabling of HARQ feedback for IoT NTN were achieved:

**RAN1-109e**

Agreement

*For IoT NTN, to configure/indicate enabling/disabling on HARQ feedback for downlink transmission, one or more of the following options can be considered:*

* *Option 1: per HARQ process via UE specific RRC signaling*
* *Option 2: per HARQ process via SIB signaling*
* *Option 3: explicitly indicated by DCI (e.g., new field or reusing existing field)*
* *Option 4: implicitly determined by existing configured/indicated parameter(s) (e.g., repetition number, TBS)*
* *Option 5: per HARQ process via MAC CE*
* *Other options or combinations are not excluded*

*Note: Option(s) for eMTC and NBIoT can be separately discussed.*

Agreement

*For IoT NTN, further study the potential issues due to enabling/disabling on HARQ feedback for downlink transmission*

* *Issue A: SPS PDSCH*
* *Issue B: (N)PDSCH/(N)PDCCH scheduling restriction*
* *Issue C: HARQ feedback for scheduling multiple TB*
* *Issue D: HARQ bundling for eMTC HD-FDD*
* *Issue F: NPRACH capacity*
* *Issue G: Serving cell/satellite change during data transfer (FFS: for eMTC and/or NB-IoT)*
* *Other issues are not excluded*

*Note: The “Issues” in common for eMTC and NB-IoT can be separately discussed.*

**RAN1-110**

Agreement

*For eMTC NTN, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission, down select one or more from the following options:*

* *Option 1: per HARQ process via UE specific RRC signaling.*
* *Option 3: explicitly indicated by DCI (e.g., new field or reusing existing field).*
* *Option 4: implicitly indicated by existing configured/indicated/combined parameter(s) in the DCI (e.g., repetition number, TBS)*
* *Option 6: combinations of some options above.*

Agreement

*For NB-IoT NTN, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission, down select one or more from the following options:*

* *Option 1: per HARQ process via UE specific RRC signaling*
* *Option 3: explicitly indicated by DCI (e.g., new field or reusing existing field)*
* *Option 4: implicitly indicated by existing configured/indicated/combined parameter(s) in the DCI (e.g., repetition number, TBS)*
* *Option 6: combinations of some options above*

Agreement

*For a DL HARQ process with disabled HARQ feedback in NB-IoT, at least the following UE behavior(s) can be considered:*

* *Option 1: UE is not expected to receive another NPDCCH carrying a DCI scheduling a NPDSCH for a given HARQ process that starts until X(ms) after the end of the reception of the last NPDSCH for that HARQ process.*
	+ *X =12*
* *Option 2: UE is not required to monitor NPDCCH in a period of Y(ms) from the end of reception of the last NPDSCH*
	+ *Y=12*

*Note: it may be different UE behaviors for different UE categories (e.g., UE with single/multiple HARQ processes).*

**RAN1-110bis-e**

Agreement

*For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH in a period of Y=12(ms) from the end of reception of the NPDSCH.*

Agreement

*For NB-IoT NTN, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission, down select* ***ONE*** *from the following options at RAN1#111:*

* *Option 6a-1: Support RRC signaling configured between Option 1 and Option 3*
* *Option 6a-4: Support Option 1 by default, and support Option 3 to override default configuration for corresponding transmission*

**RAN1-111**

***Working assumption***

*For NB-IoT NTN and eMTC NTN for CE Mode B, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission:*

* *Support Option 1 by default, and support Option 3 to override default configuration for corresponding transmission*
	+ *Additional RRC signaling to enable Option 3*
	+ *If the bitmap for option 1 is not present and if option 3 is configured then the DCI directly indicates HARQ enable/disable. Option 3 can also be configured when the bitmap for option 1 is configured.*
	+ *FFS #1: Option 3 DCI-based overridden mechanism is applied to both semi-statically HARQ enabled and disabled processes or only applied to semi-statically HARQ disabled processes or only applied to semi-statically HARQ enabled processes.*
	+ *FFS #2: whether/how to support Option 3 overriding default configuration for corresponding transmission for multiple TBs scheduled by single DCI*

*For eMTC NTN, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission, take Option 1 for CE Mode A.*

**RAN1-112**

*Conclusion*

*For eMTC HD-FDD single TB scheduled by single DCI, UE is not expected to receive a DCI with “HARQ-ACK bundling flag” field set to 1 in case the corresponding HARQ process is configured with HARQ feedback disabled by RRC signaling.*

*Agreement*

*For a DL HARQ process with disabled HARQ feedback in eMTC, UE is not expected to receive another MPDCCH carrying a DCI scheduling a PDSCH for a given HARQ process or to receive another PDSCH without corresponding MPDCCH for the given HARQ process that starts at a BL/CE DL subframe until X=3 (ms) have passed after the end of the reception of the last PDSCH for that HARQ process.*

*Agreement*

*For HARQ feedback for eMTC SPS PDSCH, at least the following is supported: UE follows the per-process HARQ feedback enabled/disabled configuration for the associated HARQ process except for the first SPS PDSCH after activation*

* *for the first SPS PDSCH after activation,*
	+ *Option 1: If HARQ feedback for SPS activation is additionally enabled, ACK/NACK is reported by UE for the first SPS PDSCH after activation regardless of network configuration of enabled/disabled for this HARQ process, and follow per-process HARQ feedback enabled/disabled configuration otherwise.*

*Conclusion*

*For DCI indicating SPS PDSCH release, HARQ-ACK report is performed as legacy in eMTC, regardless of HARQ feedback enabled/disabled configuration.*

*Agreement*

*For DCI-based overridden mechanism/indication in single TB scheduled by DCI, down select one of the following alternatives based on the criteria DCI overhead, PDCCH monitoring/power consumption, HARQ timer, impact on scheduling flexibility, UE implementation complexity*

* *Alternative 1: applies to both semi-statically HARQ enabled and disabled processes*
* *Alternative 2: only applied to semi-statically HARQ disabled processes*
* *Alternative 3: only applied to semi-statically HARQ enabled processes*

*Agreement*

*Confirm the following working assumption with the following update:*

*Working assumption*

*For NB-IoT NTN and eMTC NTN for CE Mode B, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission:*

* *Support Option 1 in case only per-HARQ process bitmap signaling is configured*
* *Support Option 3 DCI direct indication of HARQ feedback enable/disable in case only DCI solution enabling/disabling signaling is configured*
* *Support Option 3 DCI indication to override Option 1 configuration for corresponding transmission in case both per-HARQ process bitmap and DCI solution enabling/disabling signaling are configured*
	+ *FFS #1: Option 3 DCI-based overridden mechanism is applied to both semi-statically HARQ feedback enabled and disabled processes or only applied to semi-statically HARQ feedback disabled processes or only applied to semi-statically HARQ feedback enabled processes.*
	+ *FFS #2: whether/how to support Option 3 overriding Option 1 configuration for corresponding transmission for multiple TBs scheduled by single DCI*
	+ *FFS#3：Option 3 DCI-based overridden mechanism is DCI signaling to reverse the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration or DCI signaling to directly indicate the HARQ feedback enable/disable for the corresponding transmission regardless of per-HARQ process RRC configuration.*

*RAN1 strives to have a common design (in terms of DCI design, PDCCH monitoring, etc.) for “Option 3” and “Option 3 + Option 1”.*

*For eMTC NTN, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission, take Option 1 for CE Mode A.*

*Agreement*

*For DCI-based overridden/direct indication, down select one of the following based on the criteria DCI overhead, PDCCH monitoring behavior, impact on scheduling flexibility, UE implementation complexity, etc*

* *Option 1: Indication by adding one field in DCI*
* *Option 2: Indication by reusing/reinterpreting existing field in DCI*

**RAN1-112bis-e**

*Agreement*

*For Option 3 DCI indication:*

* *Option A: when both per-HARQ process bitmap and DCI solution enabling/disabling signaling are configured*
	+ *DCI-based overridden mechanism is DCI signaling to reverse the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration*
		- *For single TB scheduled by DCI, the DCI based overridden indication is applied to one of the following options (to be down-selected):*
			* *Option A-1: only applied to semi-statically HARQ disabled processes*
			* *Option A-4: applied to both semi-statically HARQ disabled and enabled processes*
		- *FFS for multiple TBs scheduled by single DCI*
* *Option B: DCI-based HARQ enabling/disabling direct indication in case DCI solution enabling/disabling signaling is configured and per-HARQ process bitmap signaling is not configured (i.e. no bitmap is configured)*
	+ *DCI-based mechanism is DCI signaling to directly indicate the HARQ feedback enable/disable for the corresponding transmission*
		- *For single TB scheduled by DCI, DCI-based direct indication is applied to the scheduled TB*
		- *FFS for multiple TBs scheduled by single DCI*

*Agreement*

*For single TB scheduled by DCI, for DCI-based direct indication, down select one of the following based on the criteria DCI overhead, PDCCH monitoring behavior, impact on scheduling flexibility, UE implementation complexity, etc*

* *Option 1: Indication by adding one field in DCI (e.g., 1-bit)*
	+ *Note: Other fields in DCI are the same as legacy.*
* *Option 2: Indication by reusing/reinterpreting existing field in DCI*
	+ *Option 2A: HARQ-ACK related field*
		- *For eMTC CE mode B, one state of “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.*
			* *FFS: detailed state*
		- *For NBIoT, one state of “HARQ-ACK resource” field in DCI format N1 is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.*
			* *FFS: detailed state*
	+ *Option 2B: MCS or repetition number field*
		- *Reduce 1bit of legacy MCS or repetition number field and add 1bit new field in DCI format 6-1B and N1 to indicate the HARQ feedback enabled/disabled*
			* *FFS: detailed for interpreting of the reduced MCS or repetition number field*
	+ *Option 2C: HARQ-ACK related field v2*
		- *For eMTC CE mode B, reduce 1bit of legacy “HARQ-ACK resource offset” field and add 1bit new field in DCI format 6-1B to indicate the HARQ feedback enabled/disabled*
			* *FFS: detailed for interpreting of the reduced “HARQ-ACK resource offset” field*
		- *For NBIoT, reduce 1bit of legacy “HARQ-ACK resource” field and add 1bit new field in DCI format N1 to indicate the HARQ feedback enabled/disabled*
			* *FFS: detailed for interpreting of the reduced “HARQ-ACK resource” field*
	+ *Option 2D: Other indication by reusing/reinterpreting existing field*

**RAN1-113**

***Working assumption***

*For DCI-based direct indication in single TB scheduled by DCI,*

* *Indication by reusing/reinterpreting HARQ-ACK related field in DCI*
	+ - *For eMTC CE mode B, one state of “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.*
			* *FFS: detailed state, and whether this state is different across different UEs*
		- *For NBIoT, one state of “HARQ-ACK resource” field in DCI format N1 is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.*
			* *FFS: detailed state, and whether this state is different across different UEs*
* *If reusing/reinterpreting HARQ-ACK related field in DCI is also used for DCI overriding scheme, the interpretation of the state can be different than for DCI-based direct indication.*

***Agreement***

*For single TB scheduled by DCI,*

* *Working assumption 1 DCI based overridden indication is applied to both semi-statically HARQ disabled and enabled processes*
	+ *For DCI based overridden indication, adopt indication by reusing/reinterpreting HARQ-ACK related field in DCI*
		- *For eMTC CE mode B, “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of maintaining/reversing the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration and corresponding HARQ-ACK resource in case of indication of HARQ feedback enabled.*
			* *HARQ feedback disabled is reversed to enabled in case of any states other than state A in “HARQ-ACK resource offset”, otherwise is maintained as disabled.*
			* *HARQ feedback enabled is maintained in case of any states other than state A in “HARQ-ACK resource offset”, otherwise is reversed to disabled.*
				+ *FFS: detailed state A, and whether this state A is different across different UEs*
		- *For NBIoT, “HARQ-ACK resource” field in DCI format N1 is used for indication of maintaining/reversing the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration and corresponding HARQ-ACK resource in case of indication of HARQ feedback enabled.*
			* *The same DCI indication functionality as eMTC is adopted.*
* *Working assumption 2 For Option 1 + Option 3 DCI based overridden mechanism, for a HARQ process configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH for the same HARQ process (or monitoring any NPDCCH for the case of single HARQ process configuration).*
* *Send an LS to RAN2 with the following contents:*
	+ *RAN1 respectfully ask RAN2 for the feasibility of Working assumption 2 (taking into account potential RAN2 spec impact).*

***Agreement***

*The draft LS in R1-2306205 is endorsed. Final LS in R1-2306245.*

***Agreement***

*For the RRC configuration of DCI solution enabling/disabling of HARQ feedback for NB-IoT and LTE-MTC in CE Mode B, the RRC configuration is UE-specific.*

***Agreement***

*for NB-IoT and LTE-MTC in CE Mode B, if multiple TBs is configured, for DCI-based HARQ enabling/disabling direct indication in multiple TBs scheduled by single DCI, the same indication is applied to all scheduled TBs, i.e. HARQ is enabled or disabled for all TBs.*

**RAN1-114**

*Agreement*

*Confirm the following working assumption:*

*Working assumption*

*For DCI-based direct indication in single TB scheduled by DCI,*

* *Indication by reusing/reinterpreting HARQ-ACK related field in DCI*
	+ - *For eMTC CE mode B, one state of “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.*
			* *FFS: detailed state, and whether this state is different across different UEs*
		- *For NBIoT, one state of “HARQ-ACK resource” field in DCI format N1 is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.*
			* *FFS: detailed state, and whether this state is different across different UEs*
* *If reusing/reinterpreting HARQ-ACK related field in DCI is also used for DCI overriding scheme, the interpretation of the state can be different than for DCI-based direct indication.*

*For single TB scheduled by DCI,*

* *Working assumption 1 DCI based overridden indication is applied to both semi-statically HARQ disabled and enabled processes*
	+ *For DCI based overridden indication, adopt indication by reusing/reinterpreting HARQ-ACK related field in DCI*
		- *For eMTC CE mode B, “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of maintaining/reversing the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration and corresponding HARQ-ACK resource in case of indication of HARQ feedback enabled.*
			* *HARQ feedback disabled is reversed to enabled in case of any states other than state A in “HARQ-ACK resource offset”, otherwise is maintained as disabled.*
			* *HARQ feedback enabled is maintained in case of any states other than state A in “HARQ-ACK resource offset”, otherwise is reversed to disabled.*
				+ *FFS: detailed state A, and whether this state A is different across different UEs*
		- *For NBIoT, “HARQ-ACK resource” field in DCI format N1 is used for indication of maintaining/reversing the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration and corresponding HARQ-ACK resource in case of indication of HARQ feedback enabled.*
			* *The same DCI indication functionality as eMTC is adopted.*

*Agreement*

*For DCI-based direct indication in multiple TBs scheduled by single DCI, reuse/reinterpret the HARQ-ACK related field in corresponding DCI for indication of HARQ feedback enabled/disabled.*

* *The same DCI direct indication functionality as single TB scheduled by DCI scenarios. (i.e., same state of HARQ related field is used)*

*Agreement*

*For the DCI based overridden indication for multiple TBs scheduled by single DCI,*

* *reuse/reinterpret the HARQ-ACK related field in corresponding DCI for overridden indication of HARQ feedback enabled/disabled.*
	+ *The same DCI overridden indication functionality as single TB scheduled by DCI scenarios.*
		- *This implies that all scheduled TBs by single DCI are HARQ feedback enabled or HARQ feedback disabled by the DCI overridden indication.*

*Agreement*

*For both RRC bitmap-based solution and DCI-based solutions (i.e., DCI-based direct indication and DCI-based overridden indication),*

* *For LTE-MTC/NB-IoT multiple TBs scheduled by single DCI without HARQ-ACK bundling,*
	+ *HARQ feedback is reported for each TB at least in case that all TBs scheduled by single DCI are configured/indicated as HARQ feedback enabled.*
	+ *HARQ feedback is not reported at least in case all TBs scheduled by single DCI are configured/indicated as HARQ feedback disabled.*
* *For LTE-MTC/NB-IoT multiple TBs scheduled by single DCI with HARQ-ACK bundling,*
	+ *bundled HARQ feedback is reported at least in case that all TBs scheduled by single DCI are configured/indicated as HARQ feedback enabled.*
	+ *HARQ feedback is not reported at least in case all TBs scheduled by single DCI are configured/indicated as HARQ feedback disabled.*

*Agreement*

*For LTE-MTC/NB-IoT, for the multiple TBs scheduled by single DCI with only RRC bitmap-based solution configuration, down select one of the options at RAN1#114.*

* *Option 2: Support mixed HARQ feedback enabled/disabled configuration, and in case of mixed HARQ feedback enabled/disabled configuration,*
	+ *Option 2a: HARQ feedback is always reported based on the decoding results of corresponding transmission for all scheduled TBs for both HARQ-ACK bundling and non-HARQ-ACK bundling cases.*
	+ *Option 2c: HARQ feedback is reported or not for all scheduled TBs depending on the HARQ feedback enabled/disabled configuration of the TB with the lowest HARQ process number among scheduled TBs for both HARQ-ACK bundling and non-HARQ-ACK bundling cases.*
	+ *Option 2d: HARQ feedback is reported for TB with HARQ feedback enabled configuration and ACK is reported for TB with HARQ feedback disabled configuration for both HARQ-ACK bundling and non-HARQ-ACK bundling cases.*
	+ *Option 2e: HARQ feedback is reported for TB with HARQ feedback enabled configuration.*
		- *Without HARQ-ACK bundling*
			* *HARQ feedback is not reported for TB with HARQ feedback disabled configuration.*
			* *HARQ timing for TBs with HARQ feedback enabled configuration does not count the legacy HARQ-ACK resource/HARQ timing adopted for TBs with HARQ feedback disabled configuration.*
		- *With HARQ-ACK bundling*
			* *HARQ feedback is not reported for TB with HARQ feedback disabled configuration.*
				+ *Mapping of TBs to bundles is done as per legacy (i.e., TS36.213 Table 7.3-1 for LTE-MTC) based on all scheduled TBs.*
				+ *The TB with HARQ feedback disabled configuration does not count in the HARQ bundling (i.e., it is not part of the logical AND operation). If all TBs in a bundle have HARQ feedback disabled, the UE does not send HARQ-ACK corresponding to this TB bundle.*
				+ *HARQ timing for bundles for which HARQ-ACK feedback is sent do not count the legacy HARQ-ACK resource/HARQ timing adopted for bundles for which HARQ-ACK feedback is not sent.*
* *Note: mixed HARQ feedback enabled/disabled configuration means among TBs scheduled by single DCI, some TBs are RRC configured as HARQ feedback enabled, and the other TBs are RRC configured as HARQ feedback disabled.*

*Agreement*

*For LTE-MTC/NB-IoT, for the multiple TBs scheduled by single DCI with only RRC bitmap-based solution configuration and with mixed HARQ feedback enabled/disabled scheduling*

* *Without HARQ-ACK bundling*
	+ *HARQ feedback is not reported for TB with HARQ feedback disabled configuration.*
	+ *HARQ timing for TBs with HARQ feedback enabled configuration does not count the legacy HARQ-ACK resource/HARQ timing adopted for TBs with HARQ feedback disabled configuration. (Option 2e)*
* *With HARQ-ACK bundling*
	+ *Option 2f-b: ACK is reported for TB with HARQ feedback disabled configuration for HARQ-ACK bundling. No change to HARQ feedback timeline. (Option 2d)*

*Agreement*

*For DCI-based direct/overridden indication, for the state of HARQ-related field (i.e., “HARQ-ACK resource offset” field for eMTC, “HARQ-ACK resource” field for NBIoT) in DCI to indicate the HARQ feedback enabled/disabled.*

* *Option 1: one common state is used for all UEs*
	+ *Option 1-1: the state of indication of HARQ feedback disabled and state A are state of “11” for eMTC and state of “1111” for NB-IoT (i.e., for both 3.75kHz and 15kHz subcarrier spacing) respectively.*

**RAN1-114bis**

*Agreement*

*Confirm the following working assumptions from RAN1#113:*

*For single TB scheduled by DCI,*

* *Working assumption 2 For Option 1 + Option 3 DCI based overridden mechanism, for a HARQ process configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH for the same HARQ process (or monitoring any NPDCCH for the case of single HARQ process configuration).*

*Agreement*

*The TP1b in section 13 of [R1-2310356](https://ericsson-my.sharepoint.com/personal/gerardo_agni_medina_acosta_ericsson_com/Documents/Documents/3GPP_RAN1_Delegate/RAN1_115_Chicago/Docs/R1-2310356.zip) is endorsed for TS36.213 clause 7.3.*

*Agreement*

*The TP2b in [R1-2310356](https://ericsson-my.sharepoint.com/personal/gerardo_agni_medina_acosta_ericsson_com/Documents/Documents/3GPP_RAN1_Delegate/RAN1_115_Chicago/Docs/R1-2310356.zip) is endorsed for TS36.213 clause 16.4.2.*

*Agreement*

*There is ambiguity for definition of NTB in clause 7.1.7.1 and 10.2 as follows:*

* *For clause 10.2: NTB is the number of TBs with HARQ feedback enabled*
* *For clause 7.1.7.1: NTB is the number of scheduled TBs*

*It is recommended to the spec editor of TS36.213 to resolve that ambiguity accounting for HARQ feedback enabling/disabling.*

This document provides the proposals and summary of discussions with detailed proposals from each company listed in appendix according to the inputs. Companies are encouraged to provide the inputs in the discussion.

# [Active] Further discussion of the Working assumption 2 in RAN1-113

Based on the incoming LS from RAN2 (R2-2308993), RAN1-114bis has confirmed the following working assumption (Working Assumption 2) from RAN1#113.

*For single TB scheduled by DCI,*

* *Working assumption 2 For Option 1 + Option 3 DCI based overridden mechanism, for a HARQ process configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH for the same HARQ process (or monitoring any NPDCCH for the case of single HARQ process configuration).*

However, as observed by [E///] that the Working Assumption 2 above states “For single TB scheduled by DCI,” a question was raised on whether multi-TB grant should also be included. [E///] proposes to confirm the working assumption adopted to multiple TBs case. [Spreadtrum] proposes to update the working assumption that if only all HARQ process reversed to HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms. [MTK] further mentioned that Multi-TB for NPDCCH monitoring restriction issue has not been discussed yet, when one/more TBs are disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI, and there is misunderstanding on the except cases where UE should utilize NPDCCH monitoring restriction with Type B half-duplex guard periods, whether the except cases are for both TN and NTN.

TP 1-1a MTK R1-2311998

|  |  |
| --- | --- |
| **Reason for change:** |  |
|  |  |
| **Summary of change:** |  |
|  |  |
| **Consequences if not approved:** |  |

========================= Start of TP #1 for TS 36.213 =========================

## 16.6 Narrowband physical downlink control channel related procedures

<Unchanged parts are omitted>

If a NB-IoT UE is configured with higher layer parameter *twoHARQ-ProcessesConfig*

- and if the UE has a NPUSCH transmission ending in subframe *n*,

- the UE is not required to receive transmissions in the Type B half-duplex guard periods as specified in [3]for FDD ; and

- in a non NTN serving cell, the UE is not expected to receive an NPDCCH with DCI format N0/N1 for the same HARQ process ID as the NPUSCH transmission in any subframe starting from subframe n+1 to subframe n+3,

- or in a NTN serving cell, the UE is not expected to receive an NPDCCH with DCI format N0/N1 for the same HARQ process ID as the NPUSCH transmission in any downlink subframe that overlaps with uplink subframe *n*+1 to subframe *n*+*K*mac+3except if the UE is configured with higher layer parameter *uplinkHARQ-mode* set to ‘*HARQModeB*’ for the same HARQ process ID, or if the NPUSCH transmission carries ACK/NACK response, as determined in clause 16.4.2, for the same HARQ process ID, and the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for the same HARQ process ID and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB;*

else if the UE is not using higher layer parameter *edt-Parameters* or if the UE is using higher layer parameter *edt-Parameters* and 

- if the NB-IoT UE has a NPUSCH transmission ending in subframe *n*,

 - the UE is not required to receive transmissions in the Type B half-duplex guard periods as specified in [3] for FDD; and

- in a non NTN serving cell, the UE is not required to monitor NPDCCH in any subframe starting from subframe *n+1* to subframe *n+3*,

- or in a NTN serving cell, the UE is not required to monitor NPDCCH in any downlink subframe that overlaps with uplink subframe *n*+*1* to subframe *n*+*K*mac+*3* except if the UE is configured with higher layer parameter *uplinkHARQ-mode* set to ‘*HARQModeB*’, or if the UE is not configured with *npdsch-MultiTB-Config* and if the NPUSCH transmission carries ACK/NACK response as determined in clause 16.4.2 and the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB*.

<Unchanged parts are omitted>

========================= End of TP #1 for TS 36.213 =========================

TP 1-0 legacy TS36.213

TS36.213 v18.0.0 clause 16.6

If a NB-IoT UE is configured with higher layer parameter *twoHARQ-ProcessesConfig*

- and if the UE has a NPUSCH transmission ending in subframe *n*,

- the UE is not required to receive transmissions in the Type B half-duplex guard periods as specified in [3]for FDD ; and

- the UE is not expected to receive an NPDCCH with DCI format N0/N1 for the same HARQ process ID as the NPUSCH transmission in any subframe starting from subframe n+1 to subframe n+3, or in a NTN serving cell, in any downlink subframe that overlaps with uplink subframe *n*+1 to subframe *n*+*K*mac+3 except if the UE is configured with higher layer parameter *uplinkHARQ-mode* set to ‘*HARQModeB*’ for the same HARQ process ID, or if the NPUSCH transmission carries ACK/NACK response, as determined in clause 16.4.2, for the same HARQ process ID, and the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for the same HARQ process ID and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB;*

else if the UE is not using higher layer parameter *edt-Parameters* or if the UE is using higher layer parameter *edt-Parameters* and 

- if the NB-IoT UE has a NPUSCH transmission ending in subframe *n*,

- the UE is not required to receive transmissions in the Type B half-duplex guard periods as specified in [3] for FDD; and

- the UE is not required to monitor NPDCCH in any subframe starting from subframe *n+1* to subframe *n+3* or in a NTN serving cell, in any downlink subframe that overlaps with uplink subframe *n*+*1* to subframe *n*+*K*mac+3 except if the UE is configured with higher layer parameter *uplinkHARQ-mode* set to ‘*HARQModeB*’, or if the NPUSCH transmission carries ACK/NACK response as determined in clause 16.4.2 and the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB*.

Furthermore, RAN2-123bis has achieved the following agreement related to IoT NTN HARQ disabling, especially for multiple TBs scheduled by single DCI.

Agreements:

1. For NB-IoT UE configured with two HARQ processes and at least one of them is configured with HARQ mode B, RAN2 does no change to the operation on drx-InactivityTimer for single TB scheduling case.
2. For eMTC over NTN with HARQ process configured with HARQ mode B, there is no need to change drx-InactivityTimer operation.
3. For NB-IoT, for a HARQ process configured as HARQ feedback enabled by RRC and further reversed to HARQ feedback disabled by DCI, UE behaviour on DRX follows the case when HARQ feedback is disabled (e.g., not start the corresponding DL HARQ RTT Timer for this HARQ process, and for NB-IoT NTN with single HARQ processes, start drx-InactivityTimer in the subframe containing the last repetition of the PDSCH plus 12 subframes plus deltaPDCCH).
4. For multiple TB scheduling with the same HARQ feedback enabled configuration at least by RRC, HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated as legacy.
5. In Rel-18 IoT NTN, if a NB-IoT UE receives a PDCCH indicating the transmission for multiple DL TBs, UE stops drx-InactivityTimer as legacy, regardless of the enabling/disabling HARQ feedback configuration for each of the multiple scheduled TB.
6. For UL multiple TB scheduling, UE only starts the UL HARQ RTT Timer for the HARQ process(es) with HARQ mode A.
7. In Rel-18 IoT NTN, if a NB-IoT UE receives a PDCCH indicating the transmission for UL multiple TBs, UE stops drx-InactivityTimer as legacy, regardless of the HARQ mode configuration for each of the multiple scheduled TB.
8. HARQ feedback enabled/disabled and HARQ mode configuration related to SPS are already perfectly captured by the NOTE in stage-2 running CR (no further spec changes are needed)

With RAN2 discussion, according to the current MAC spec, for DL multiple-TB scheduling case, HARQ RTT Timers for all HARQ processes corresponding to the scheduled TBs are started simultaneously and have the same timer length, causing *drx-RetransmissionTimers* for all these HARQ processes to be stared simultaneously as well. With the introduction of the HARQ feedback disabling in Rel.18, the corresponding HARQ related timer are discussed in RAN2. However, there is no consensus on HARQ RTT timer calculation for mixed HARQ feedback enabled/disabled configuration.

Proposal 10 For multiple TB scheduling with mixed HARQ feedback enabled/disabled configuration, if HARQ-ACK bundling is not configured, HARQ RTT Timer is calculated based on the number of scheduled TBs with DL HARQ feedback enabled.

* QC thinks this might not work in all cases and thinks we should not change
* Huawei thinks p10 aligns with RAN1 understanding and then supports it. Ericsson agrees. Nokia also agrees
* Continue in offline 308 (R2-2311320)

Question 1: To align the UE behavior for multiple TBs scheduled by single DCI, do you agree the following proposal?

**Proposal 1-1a**

For multiple TBs scheduled by single DCI, down-select one of the following UE behavior.

* Alternative 1: For Option 1 + Option 3 DCI based overridden mechanism, only for all HARQ process configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH ~~for the same HARQ process~~.
* Alternation 2: For Option 1 + Option 3 DCI based overridden mechanism, no matter of HARQ feedback configuration by per-HARQ process bitmap signaling and further indicated as HARQ feedback enabled by DCI, the NBIoT UE always wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH ~~for the same HARQ process~~.

Question 2: do you think clarification of the text TP 1-1a MTK R1-2311998 needed compared with original text in TP 1-0 TS36.213 v18.0.0 (e.g., separate texts for TN and NTN)?

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | We think that legacy text as per the latest version of the specification is ok. The legacy text is agnostic to single-TB grant and Multi-TB grant therefore covers both. MediaTek’s TP just adds a bullet-based description and the Multi-TB grant case is excluded, but in our view there is no reason to do that since in our understanding the procedure in 16.6 equally works for both single TB-grant and Multi-TB grant (i.e., when DCI-based overriding solution applies for Multi-TB grant, the same principle of early monitoring in DL towards receiving blind (re-) transmissions applies, it does not have to be different as compared to Single-TB grant, thus clause 16.6 works for both without any further update). Moreover, in the UE Feature List it has already been captured the DCI-based overriding behavior for Multi-TB grant, see for example FG 2-1g-2 (fourth column from left-to-right, 2nd bullet):

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. IoT\_NTN\_enh | 2-1g-2 | Dynamic HARQ feedback disabling by DCI-based overridden indication for NB-IoT in multi TB case | 1. UE receives DCI indication to override RRC configuration for disabling HARQ feedback 2. For single TB scheduled by single DCI, UE follows NPDCCH monitoring behavior for a HARQ process configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI | At least one of {Rel-16 2-6, 2-7},Rel. 17 2-1,Rel-18 2-1e-2, 2-1f-2 | Yes | N/A | Release 18 NB-IoT UE cannot disable HARQ feedback in multi TB case | [Per UE/Per band] | No  | No | Note: HARQ disabling with Option 1 + Option 3 Note: this applies to multi-TB case[Note: RAN1 kindly asks RAN2 to design signalling such that GSO/NGSO differentiation is possible] | Optional with capability signalling |

 |
| MediaTek | Support Alt.2For multi-TB, there are six cases involve RRC disabled and DCI enabled:1. With bundling, First TB is enabled by RRC, second TB is disabled by RRC, DCI indicates enabled
2. With bundling, First TB is disabled by RRC, second TB is enabled by RRC, DCI indicates enabled
3. With bundling, First TB is disabled by RRC, second TB is disabled by RRC, DCI indicates enabled
4. Without bundling, First TB is enabled by RRC, second TB is disabled by RRC, DCI indicates enabled
5. Without bundling, First TB is disabled by RRC, second TB is enabled by RRC, DCI indicates enabled
6. Without bundling, First TB is disabled by RRC, second TB is disabled by RRC, DCI indicates enabled

Current spec can not directly be applicable to all above cases, RAN1 and RAN2 need to further discuss.To simplify the issue in RAN1 and RAN2, we support Alt 2. |
| Huawei, HiSilicon | We prefer alter 2 for the simplicity. |
| Ericsson | To MediaTek:The mixed case only “happens” for the bitmap-based solution. That is, for the DCI-based direct indication solution and DCI-based overriding solution, the dynamic indication applies to all TB scheduled by a single DCI (e.g., in the case of the DCI-based overriding solution, what was semi-statically configured is overridden to either all HARQ feedback enabled or all HARQ feedback disabled).Based on the above, we will have the following outcome for the cases listed by MediaTek:* For 1), 2) and 3), bundled HARQ feedback is reported and since among the TBs scheduled by a single DCI there was (at least) one with HARQ feedback disabled that was further reversed to HARQ feedback enabled via DCI, then the NB-IoT UE does not wait for an RTT+3ms.
* For 4), 5) and 6), HARQ feedback is reported for each TB and since among the TBs scheduled by a single DCI there was (at least) one with HARQ feedback disabled that was further reversed to HARQ feedback enabled via DCI, then the NB-IoT UE does not wait for an RTT+3ms.

As you can see, the listed cases are basically subject to the same principle described in clause 16.6 to early monitoring in DL towards receiving blind (re-) transmissions. |
| Nokia, NSB | We also agree Alt2 is simple. |
| FL | To MTK and EricssonIt seems Ericsson’s comment is not aligned with the current spec if I understand it correctly.Let’s take the following case as an example, eNB schedules two TBs (HARQ process 0 and HARQ process 1), and HARQ process 0 is configured as HARQ feedback enabled, and HARQ process 1 is configured as HARQ feedback disabled, and DCI indicates the HARQ feedback enabled, what is the UE behavior for NPDCCH monitoring?From my understanding, the UE behavior should follow the highlighted part in TS36.213 from Ericsson’s comment, however, * what is the HARQ process ID for “the same HARQ process ID” in above example, HARQ process 1? And what is the UE behavior for HARQ process 0? Wait or not wait?
* The highlighted part is targeted for one TB (e.g., *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for the same HARQ process ID)
* Since there is only one HARQ RTT timer for multiple TBs case, it is better to follow the same UE behavior for mixed scheduled TBs.

the UE is not expected to receive an NPDCCH with DCI format N0/N1 for the same HARQ process ID as the NPUSCH transmission in any subframe starting from subframe n+1 to subframe n+3, or in a NTN serving cell, in any downlink subframe that overlaps with uplink subframe *n*+1 to subframe *n*+*K*mac+3 except if the UE is configured with higher layer parameter *uplinkHARQ-mode* set to ‘*HARQModeB*’ for the same HARQ process ID, or if the NPUSCH transmission carries ACK/NACK response, as determined in clause 16.4.2, for the same HARQ process ID, and the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for the same HARQ process ID and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB;*it seems Ericsson’s comment should be alternative 3?**Proposal 1-1b**For multiple TBs scheduled by single DCI, down-select one of the following UE behavior.* Alternative 1: For Option 1 + Option 3 DCI based overridden mechanism, only for all HARQ processes configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH ~~for the same HARQ process~~.
* Alternative 2: For Option 1 + Option 3 DCI based overridden mechanism, no matter of HARQ feedback configuration by per-HARQ process bitmap signaling and further indicated as HARQ feedback enabled by DCI, the NBIoT UE always wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH ~~for the same HARQ process~~.
* Alternative 3: For Option 1 + Option 3 DCI based overridden mechanism, at least one of HARQ processes configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further indicated as HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH ~~for the same HARQ process~~.
 |
| ZTE | Whether current specification can work for multi-TB case may be discussed first. If it is consensus that current spec is not enough, we can further discuss the alternatives. |

# [Active] Capture three HARQ feedback disabled indication schemes for eMTC

In R18 IoT NTN, there are three HARQ disabling schemes adopted, i.e. RRC-only scheme, DCI-based direct indication scheme and DCI-based overridden indication scheme.

* For RRC-only, only higher larger parameter of *downlinkHARQ-FeedbackDisabled-Bitmap* is configured.
* For DCI-based direct indication, only higher layer parameter of *downlinkHARQ-FeedbackDisabled-DCI* is configured.
* For DCI-based overridden indication, both *downlinkHARQ-FeedbackDisabled-DCI* and *downlinkHARQ-FeedbackDisabled* are configured.

As further commented by [ZTE], after reviewing the current TS36.213 v18.0.0, it seems that the editor tried to reflect the agreement by listing the scenarios where UE shall provide HARQ-ACK for the HARQ process associated with the transport block in NTN. However, as concerned by [Huawei, ZTE, Ericsson, OPPO, Nokia] that some conditions of providing HARQ-ACK are missing, there is need to clarify the three HARQ disabling schemes in TS36.213 v18.0.0.

TP 2-1a Huawei R1-2310878

|  |  |
| --- | --- |
| **Reason for change:** | one case UE need to feedback HARQ-ACK is still missing, i.e. CEModeB UE configured with *downlinkHARQ-FeedbackDisabled-DCI* and *downlinkHARQ-FeedbackDisabled-Bitmap* indicating HARQ-ACK enabled, and HARQ feedback disabled indicator is not present in the scheduling MPDCCH. |
|  |  |
| **Summary of change:** | Reflect the RRC configuration of DCI-based overridden indication explicitly. Add a missing condition when UE should feedback HARQ-ACK. |
|  |  |
| **Consequences if not approved:** | The DCI-based overridden indication scheme is not captured. The UE behaviour is not defined when downlinkHARQ-FeedbackDisabled-Bitmap indicating HARQ-ACK enabled and downlinkHARQ-FeedbackDisabled-DCI is configured and the value of the HARQ-ACK resource offset field in the DCI format 6-1B of the corresponding MPDCCH is not set to ‘3’. |

TS36.213

## 7.3 UE procedure for reporting HARQ-ACK

If the UE is not configured with *shortTTI*, the term 'subframe/slot' refers to a subframe in this clause.

<Unchanged parts are omitted>

For a BL/CE UE in a NTN FDD serving cell, and the UE configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled/enabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, or the UE configured with CEModeB and higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI*, the UE shall provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH

* if the UE is configured with CEModeA, and configured with higher layer parameter *harq-FeedbackEnablingforSPSactive* = *'enabled'*, and the detected PDSCH is the first SPS PDSCH after SPS activation, or
* if the UE is configured with CEModeB, and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI or* both *downlinkHARQ-FeedbackDisabled-DCI* and *downlinkHARQ-FeedbackDisabled-Bitmap,* and the value of the HARQ-ACK resource offset field in the DCI format 6-1B of the corresponding MPDCCH is not set to ‘3’.

<Unchanged parts are omitted>

TP 2-2a Ericsson R1-2310965

|  |  |
| --- | --- |
| **Reason for change:** |  |
|  |  |
| **Summary of change:** |  |
|  |  |
| **Consequences if not approved:** |  |

--------------------- Text Start -------------

## 7.3 UE procedure for reporting HARQ-ACK

----------------- Text Omitted ------------------

For a BL/CE UE in a NTN FDD serving cell configured with CEModeA, and the UE configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, the UE shall not provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH except

- if the UE is configured with higher layer parameter *harq-FeedbackEnablingforSPSactive* = *'enabled'*, and the detected PDSCH is the first SPS PDSCH after SPS activation.

For a BL/CE UE in a NTN FDD serving cell configured with CE ModeB, the UE shall not provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH

-    if the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI*, and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap*, indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, or

- if the HARQ-ACK resource offset field functions as HARQ feedback indicator in the DCI format 6-1B as specified in [4] in the MPDCCH corresponding to the PDSCH.

-------------------------- Text End --------------------

TP 2-3a ZTE R1-2311202

|  |  |
| --- | --- |
| **Reason for change:** | There is a mixed understanding on the conditions where UE shall provide HARQ-ACK |
|  |  |
| **Summary of change:** | Specify the HARQ feedback enabling/disabling configurations for SPS scenario with CEModeA and DCI indication scenario with CEModeB in separate paragraphs. |
|  |  |
| **Consequences if not approved:** | UE behavior is ambiguous when UE configured with higher layer parameter downlinkHARQ-FeedbackDisabled-Bitmap indicating enabled HARQ-ACK information for a HARQ process associated with a transport block and configured with higher layer parameter downlinkHARQ-FeedbackDisabled-DCI. |

--------------------TP#1: Start of TP for TS 36.213 V18.0.0 ---------------------------

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

<Unchanged parts are omitted>

For a BL/CE UE in a NTN FDD serving cell, and the UE configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, the UE shall provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH

* if the UE is configured with CEModeA, and configured with higher layer parameter *harq-FeedbackEnablingforSPSactive* = *'enabled'*, and the detected PDSCH is the first SPS PDSCH after SPS activation.

For a BL/CE UE in a NTN FDD serving cell, and the UE configured with CEModeB and higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI*, the UE shall provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH

* if the HARQ-ACK Resource offset field does not function as HARQ feedback disabled indicator as specified in [4] in DCI format 6-1B in the MPDCCH corresponding to the PDSCH.

TP 2-4a OPPO R1-2311247

|  |  |
| --- | --- |
| **Reason for change:** |  |
|  |  |
| **Summary of change:** |  |
|  |  |
| **Consequences if not approved:** |  |

-------------------- start of proposed TP for 36.213 --------------------

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

<Unchanged parts are omitted>

For a BL/CE UE in a NTN FDD serving cell, and the UE not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating ~~enabled~~ disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, the UE shall not provide HARQ-ACK for the HARQ process associated with the transport block.

For a BL/CE UE in a NTN FDD serving cell, and the UE configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, or the UE configured with CEModeB and higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI*, the UE shall not provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH except

- if the UE is configured with CEModeA, and configured with higher layer parameter *harq-FeedbackEnablingforSPSactive* = *'enabled'*, and the detected PDSCH is the first SPS PDSCH after SPS activation, or

- if the UE is configured with CEModeB, and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI*, and the value of the HARQ-ACK resource offset field in the DCI format 6-1B of the corresponding MPDCCH is not set to ‘3’.

-------------------- end of proposed TP ---------------------------------

TP 2-5a Nokia R1-2311654

|  |  |
| --- | --- |
| **Reason for change:** | Mixing HARQ feedback for first SPS PDSCH in CEModeA and DCI indicated HARQ feedback in CEModeB can be confusing and difficult to understand. |
|  |  |
| **Summary of change:** | Separate DCI-based indication of HARQ feedback in CEModeB from HARQ feedback enabled conditions for CEModeA |
|  |  |
| **Consequences if not approved:** | Higher likelihood of misinterpreting specification. |

**36.213 Clause 7.3**

------------------------------ Start of Text proposal -------------------------------

For a BL/CE UE in a NTN FDD serving cell, and the UE not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating enabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, the UE shall provide HARQ-ACK for the HARQ process associated with the transport block.

For a BL/CE UE in a NTN FDD serving cell, and the UE configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, the UE shall provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH

- if the UE is configured with CEModeA, and configured with higher layer parameter *harq-FeedbackEnablingforSPSactive* = *'enabled'*, and the detected PDSCH is the first SPS PDSCH after SPS activation

For a BL/CE UE in a NTN FDD serving cell, the UE shall provide HARQ-ACK for a HARQ process associated with a transport block in a detected PDSCH

- if the UE is configured with CEModeB, and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI*, and the value of the HARQ-ACK resource offset field in the DCI format 6-1B of the corresponding MPDCCH is not set to ‘3’.

------------------------------ End of Text proposal -------------------------------

Question: do you think the current spec in TS36.213 v18.0.0 is clear enough in three HARQ feedback disabled indication schemes for eMTC, if not, what is your preference text structure/update/comments (e.g., capture the missing scenarios; list all cases that UE shall provide HARQ feedback and otherwise UE shall not by default; list all cases that UE shall not provide HARQ feedback and otherwise UE shall by default; separate text paragraph for CEMode A and CEMode B, etc), do you agree with any TPs (e.g., TP 2-1a Huawei, … ) above?

Please provide your views and comments.

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments and Views** | **Preferred TP (Original TP TS36.213 v18.0.0 by default)** |
| Ericsson | We had a discussion around this clause during RAN1# 114bis, and several companies have worked out together TP 2-2a (which includes an alignment with respect to NB-IoT’s description around the DCI). As a second preference, we can be ok with TP 2-3a. | First preference TP 2-2a, second preference TP 2-3a. |
| Huawei, HiSilicon | There is one case missing in current text that UE should feedback HARQ when both bitmap and DCI indicate the HARQ is enabled. moreover, the current description in section 7.3 may lead confusion there are only two schemes supported.  | TP2-1a, or TP2-2a (the “ HARQ feedback indicator” should be replaced with “ HARQ feedback disabled indicator” ) |
| Nokia, NSB | We think the splitting of the cases for CEmodeA and CemodeB should be the motivation for the update. No need to have other modification. | TP 2-5a or TP 2-3a  |
| ZTE | We think separating the paragraphs for CEModeA and CEModeB is needed to make it crystal clear when UE should provide HARQ-ACK. Hence, we prefer TP 2-3a which minimize the modification compared to current text and also align with the text for NB-IoT. And TP2-2a and TP2-5a are also fine to us if majority agree. | TP 2-3a.Open to 2-2a and 2-5a. |

# [Active] Clarification of TB index for HARQ timing for eMTC

As commented by [Nokia], In case when some of the scheduled TB are HARQ feedback enabled and some HARQ feedback disabled by *downlinkHARQ-FeedbackDisabled-Bitmap*, the indices of corresponds to the HARQ feedback enabled TB (for which HARQ-ACK shall be provided), with being the number of scheduled TB associated with HARQ feedback enabled processes, i.e. both and correspond to TB associated with HARQ feedback enabled process(es).

TP3-1a Nokia R1-2311654

|  |  |
| --- | --- |
| **Reason for change:** | In order to maintain a consistent index for HARQ-ACK timing in eMTC multi-TB scheduling when HARQ-ACK bundling is not configured |
|  |  |
| **Summary of change:** | Taking into account the context of “HARQ-ACK shall be provided” in the legacy text, the index b corresponding to each HARQ-ACK is reused for the scheduled TB associated with HARQ feedback enabled processes indicated by downlinkHARQ-FeedbackDisabled-Bitmap |
|  |  |
| **Consequences if not approved:** | A new set of redundant indices makes the specification difficult to understand and more likely to be misunderstood. |

------------------------------ Start of Text proposal -------------------------------

For FDD, if a BL/CE UE is configured with CEModeA, and if the UE is not configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which an HARQ-ACK shall be provided, transmit the HARQ-ACK response using the same  derived according to Clause 10.1.2.1 in subframe(s) with , *i =0,1, …, N-1*, where

- if the UE is in a NTN serving cell and the UE is configured with CEModeA and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH, or

- if the UE is in a NTN serving cell and the UE is configured with CEModeB and not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH,

-  is the number of scheduled TB associated with HARQ processes with enabled HARQ-ACK information;

- otherwise

- is the number of scheduled TB determined in the corresponding DCI;

- if the UE is not configured with higher layer parameter *interleaving* in *ce-PDSCH-MultiTB-Config* and the UE is not in half-duplex FDD operation

- ,

- otherwise

- **,**

- is the last subframe in which the PDSCH containing TB is transmitted, and TB is the -th TB for which an HARQ-ACK shall be provided;

- subframe is the last subframe in which the PDSCH is transmitted;

- denotes the number of consecutive subframes including non-BL/CE subframes where the PUCCH with HARQ ACK for TB with repetition number of *N* is transmitted;

and

*- 0≤k0<k1<…,kN-1* and the value of and  is provided by higher layer parameter *pucch-NumRepetitionCE-format1,* if configured, otherwise it is provided by higher layer parameter *pucch-NumRepetitionCE*-*Msg4-Level0-r13, pucch-NumRepetitionCE-Msg4-Level1-r13, pucch-NumRepetitionCE-Msg4-Level2-r13* or *pucch-NumRepetitionCE-Msg4-Level3-r13* depending on whether the most recent PRACH coverage enhancement level for the UE is 0, 1, 2 or 3, respectively; and

 if *N>1*

- subframe(s) with *i=0,1,…,N-1* for TB are *N* consecutive BL/CE UL subframe(s) immediately after subframe , and the set of BL/CE UL subframes are configured by higher layers;

 otherwise

- k0 =0

------------------------------ End of Text proposal -------------------------------

Question: Do you agree the need of the clarification of TB index for HARQ timing for multiple TBs, if so, do you agree the TP3-1a proposed by Nokia (e.g., with new definition of the TB *b* compared with Nokia TP last meeting)?

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | This TP was lengthy discussed online during RAN1#114bis, at that time no consensus was reached, and it was left up to the Editor of TS 36.213 to resolve the issue which in our understanding was done during the post-RAN1# 114bis e-mail discussion. |
| Qualcomm | Unclear why the TP is needed. |
| Huawei, Hisilicon | We think the TP is not necessary. The new index should be introduced to reflect the sequence of TB scheduled and sequence of TB with HARQ enabled. |
| Nokia, NSB | To avoid confusing the spec of legacy, as the index b in the legacy text corresponds to a scheduled TB with HARQ feedback enabled, we prefer to reuse it for the timing of HARQ-ACK without introducing a new index t\_b. |
| ZTE | This issue was discussed in previous meeting and agreed to be handled by editor. So not see the need of TP. |

# [Active] Clarification of maximal PDSCH number restriction in a bundle circle

As commented by [Lenovo], with the introduction of HARQ disabling for HD-FDD, the maximal PDSCH number restriction (e.g., before switching to UL) in a bundle circle should be determined by the available HARQ process number with HARQ enabled information by higher layer instead of legacy Rel.17 maximal supported HARQ process number of W=8/10/12.



TP4-1a Lenovo R1-2311728

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| --- | --- |
| **Reason for change:** | For HD-FDD, maximal PDSCH number restriction before UL subframe in a HARQ bundle circle determined by supported HARQ processes is not adopted for HARQ disabling cases. |
|  |  |
| **Summary of change:** | Add maximal PDSCH number restriction before UL subframe in a HARQ bundle circle determined by HARQ processes with configured as HARQ enabled |
|  |  |
| **Consequences if not approved:** | For HD-FDD, maximal PDSCH number restriction before UL subframe in a HARQ bundle circle is not accurate. |

TS36.213 TP recommendation

### 7.3.1 FDD HARQ-ACK reporting procedure

For FDD with PUCCH format 1a/1b transmission, when both HARQ-ACK and SR are transmitted in the same sub-frame/slot, a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH format 1a/1b resource for a negative SR transmission and transmit the HARQ-ACK on its assigned SR PUCCH resource for a positive SR transmission.

<Unchanged parts are omitted>

For a BL/CE UE in half-duplex FDD operation, if the UE is configured with CEModeA, and if the UE is configured with higher layer parameter *ce-HARQ-AckBundling* and the 'HARQ-ACK bundling flag' in the corresponding DCI is set to 1,

<Unchanged parts are omitted>

- if the UE has received *W* PDSCH transmissions before subframe *n*, and if the UE is expected to transmit HARQ-ACK for the *W* PDSCH transmissions in subframes , the UE is not expected to receive a new PDSCH transmission in subframe *n* for which the corresponding HARQ-ACK shall be provided,

- if UE is in a NTN serving cell, and the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap*,

- *W* is minimum number of *W’* and 12, where *W’* is the total HARQ processes with enabled HARQ-ACK information indicated by higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap*.

- else

- *W*=10 if higher layer parameter *ce-pdsch-tenProcesses-config* is set to 'On', *W*=12 if higher layer parameter *ce-PDSCH-14HARQ-Config* is configured, and *W*=8 otherwise.

- For *W*≥3, if the UE is expected to transmit HARQ-ACK for the PDSCH transmissions received before subframe *n* in subframes , the UE is not expected to receive a new PDSCH transmission in subframe *n* for which the HARQ-ACK is to be transmitted in subframe 

<Unchanged parts are omitted>

Question: Do you agree with Lenovo’s observation that the maximal PDSCH number restriction (e.g., before switching to UL) in a bundle circle as W=8/10/12 does not adopt to cases with HARQ feedback disabling since there may be less than 8/10/12 HARQ processes configured as HARQ feedback enabled, if so, do you agree the TP4-1a proposed by Lenovo.

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | In our understanding there is no issue, please note that the statements that in Lenovo’s view are claimed to be causing a problem are written under a Main paragraph stating: “and the 'HARQ-ACK bundling flag' in the corresponding DCI is set to 1”. Since HARQ processes with HARQ feedback disabled have their “HARQ-ACK bundling flag” set to 0, then there is no issue. |
| Qualcomm | We agree with the spirit of the proposal, but in our view we need to take into account the legacy maximum number of PDSCHs, and “min” that with the ones that have HARQ process enabled. An attempt to achieve that is in the following TP:provided, *W’*=10 if higher layer parameter *ce-pdsch-tenProcesses-config* is set to 'On', *W’*=12 if higher layer parameter *ce-PDSCH-14HARQ-Config* is configured, and *W’*=8 otherwise.If UE is configured with higher layer parameter *dowlinkHARQFeedbackDisabled-Bitmap,** *W is the minimum of W’ and the total number of HARQ process with enabled HARQ-ACK feedback.*

otherwise*,** *W=W’.*
 |
| Lenovo | To Ericsson.The text of TS36.213 “the UE is not expected to receive a new PDSCH transmission in subframe *n*” is to make eNB scheduling restriction. eNB should not do such scheduling to UE.If we don’t have the new CR proposed by Lenovo, eNB can and will schedule a new TB in subframe 6 with HARQ enabled ('HARQ-ACK bundling flag' = 1), this is not allowed/expected in UE side. |
| ZTE | Fine to further discuss. After receiving a NPDSCH, if the HARQ process with enabled feedback cannot receive new NPDSCH before transmitting HARQ-ACK, the bundle circle may need to be reduced since UE cannot collect up to 8 HARQ-ACKs when only 4 HARQ process are feedback enabled. |

# [Active] Higher layer parameters

As commented by [Huawei], it has been agreed that HARQ disabling can be configured/indicated either by RRC configuration or DCI indication or both of them. Similar to NR NTN, a bitmap for HARQ feedback enabling/disabling (e.g. *downlinkHARQ-FeedbackDisabled-Bitmap-NB*) can be optionally configured by high layer parameter. But the value range of bitmap is still undetermined. For NR NTN, the size of HARQ disabling bitmap signaling is 32. Each bit corresponding to the HARQ process ID with ascending order, and bits corresponding to HARQ process IDs that are not configured shall be ignored.

As proposed by [Huawei, Apple], for NB-IoT, the RRC bitmap length equals to the maximum number of HARQ process, i. e. 2. For eMTC, the bitmap length equals to the maximum number of HARQ process, i. e. 14. Furthermore, there is no need to define the default value.

Question: From moderator’s understanding, the remaining issue of higher layer parameters can be determined by RAN2 discussion. do you agree that it is up to RAN2 to determine the detail value range of bitmap?

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | During RAN1# 114, RAN1 has already provided input about the bitmap (i.e., guidance through a Note) as part of the HL parameter list (effectively included in the HL parameter list associated to RAN1# 114bis), the exact design is up to RAN2. Thus, there is no need to comeback to it. |
| Huawei, HiSilicon | We think it can be discussed and determined in RAN1. Similar design as NR NTN is preferred, i.e. the bitmap length equal to the maximum number of HARQ processes.  |
| Nokia, NSB | OK to be discussed in RAN2. |
| FL | Since there is one RRC parameter list discussion in this RAN1 meeting, we can move the discussion there chaired by the MTK if needed. |

# Proposals for discussion at Offline sessions

# Contact information

In order to facilitate the contact among the chairman, moderator and delegates, please feel free to add your company/responsible delegates/email information in the following table.

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# References

1. 3GPP TR 36.763 V1.0.0 (2021-06)
2. RP-213596, New WID on IoT NTN enhancements MediaTek Inc, RAN#94e