**3GPP TSG-RAN WG1 Meeting #114bisR1-230xxxx**

**Xiamen, China, October 9th - October 13th, 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.*

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] Confirm the Working assumption 2 in RAN1-113

Based on the incoming LS from RAN2 (R2-2308993), [QC] proposed to confirm the following working assumption (Working Assumption 2) from RAN1#113.

**[Proposal 1-1a]:**

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).

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | Ok, this seems to be just a formality procedure.  In our understanding the Editor CR post RAN1 113 had a placeholder on it, which prevailed during the Editor CR discussions post RAN1 114-bis. |
| Nordic | We are OK to confirm |
| Huawei, HiSilicon | RAN2 already confirmed it. Seems no need to confirmed again. |
| MediaTek | OK |
| Lenovo | We are fine with the proposal |
| Nokia, NSB | OK |

# [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] that some conditions of providing HARQ-ACK are missing, there is need to clarify the three HARQ disabling schemes in TS36.213.

TP 2-1a Huawei R1-2308911

|  |  |
| --- | --- |
| **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 ZTE R1-2309172

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

TS36.213

**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 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 value of the HARQ-ACK resource offset field in the DCI format 6-1B of the corresponding MPDCCH is not set to ‘3’, regardless of configuration of higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap*.

## --------------------End of TP for TS 36.213 V18.0.0 ---------------------------------

TP 2-3a Ericsson R1-2309888

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

7.1 UE procedure for receiving the physical downlink shared channel

<Unchanged parts are omitted>

For a BL/CE UE in a NTN FDD serving cell with a PDSCH ending in subframe *n*, and the UE configured with the higher layer parameter(s) *downlinkHARQ-FeedbackDisabled-Bitmap* or *downlinkHARQ-FeedbackDisabled-DCI* or both *downlinkHARQ-FeedbackDisabled-Bitmap* and *downlinkHARQ-FeedbackDisabled-DCI*, if the UE shall not provide HARQ-ACK for a HARQ process associated with a transport block in the PDSCH, the UE is not expected to receive a MPDCCH or a PDSCH without a corresponding MPDCCH for the same HARQ process as the PDSCH ending in subframe *n* in any BL/CE DL subframe starting from subframe *n*+1 to subframe *n*+3.

For the purpose of decoding PDSCH containing *SystemInformationBlockType2,* a BL/CE UE shall assume that subframes in which *SystemInformationBlockType2* is scheduled are non-MBSFN subframes.

If a UE is configured with more than one serving cell and if the frame structure type of any two configured serving cells is different, then the UE is considered to be configured for FDD-TDD carrier aggregation.

<Unchanged parts are omitted>

## 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 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(s) *downlinkHARQ-FeedbackDisabled-Bitmap or* *downlinkHARQ-FeedbackDisabled-DCI* or both *downlinkHARQ-FeedbackDisabled-Bitmap* and *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*, 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’.

For a BL/CE UE in half-duplex FDD operation in a NTN serving cell, if the UE is configured with CEModeA, and configured with higher layer parameter *ce-HARQ-AckBundling*, 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, the UE is not expected to receive the corresponding DCI with HARQ-ACK bundling flag set to 1.

<Unchanged parts are omitted>

Since in TS36.212, there is clear specification of the DCI states (e.g., state of “3” for HARQ-related field) and the corresponding condition on presence of the HARQ feedback disabled indicator, it seems no need for duplicated specification in TS36.213 anymore. Based on the TP from ZTE in R1-2309172, the moderator proposes the following TP for baseline discussion.

TP 2-4a Moderator

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

TS36.213

**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 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 CEModeA, and configured with higher layer parameter *harq-FeedbackEnablingforSPSactive* = *'enabled'*, 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, if the detected PDSCH is the first SPS PDSCH after SPS activation, the UE shall provide HARQ-ACK for the HARQ process associated with the transport block in the PDSCH.

For a BL/CE UE in a NTN FDD serving cell, and the UE configured with CEModeB, if the HARQ feedback disabled indicator is present in DCI format 6-1B in the MPDCCH corresponding to the PDSCH, the UE shall provide HARQ-ACK for a HARQ process associated with a transport block in the PDSCH.

## --------------------End of TP for TS 36.213 V18.0.0 ---------------------------------

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, do you agree with any TPs (e.g., TP 2-1a Huawei, … or TP 2-4a Moderator) above?

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | No. There are some aspects that need to be clarified in the current version specification. More discussion is needed aiming at making converge the proposed TPs into one. |
| Nordic | Specification is clear to us. |
| Huawei, HiSilicon | We support to sperate the conditions for RRC only and DCI-based. As for the DCI based part, the writing style read not consistent with other part. Usually, we will say, “when XXX is configured/indicated, UE will do YYY” |
| Lenovo | Frankly speaking, there are multiple ways to capture the 3 schemes. We think the current spec is clear enough. If companies hope to align with NBIoT text, TP 2-4a Moderator can be considered. Since the detail state of HARQ-related field in DCI has been captured in TS36.212, there is no need for duplicated spec in TS36.213, so it is easier to capture “the HARQ feedback disabled indicator is present in DCI format 6-1B” to avoid the potential long discussion (e.g., RRC, DCI, RRC+DCI) we also had in the last email discussion, and this writing style can be found in TS36.213 several times when we search for key words of “present” |
| SONY | We are OK with the current text.  Why do we need to say what the UE does when “both *downlinkHARQ-FeedbackDisabled-DCI* and *downlinkHARQ-FeedbackDisabled-Bitmap*” are configured when we say what happens when *downlinkHARQ-FeedbackDisabled-DCI* is configured? If both *downlinkHARQ-FeedbackDisabled-DCI* and *downlinkHARQ-FeedbackDisabled-Bitmap*” are configured then by definition *downlinkHARQ-FeedbackDisabled-DCI* is configured |
| Nokia, NSB | We think no need to update as current 36.213 is clear |

# [Active] Capture three HARQ feedback disabled indication schemes for NB-IoT

Similar issue is proposed by [Huawei, Spectrum, Nokia, E///] for the clarification of three HARQ feedback disabled indication schemes for NB-IoT.

TP 3-1a Huawei R1-2308911

|  |  |
| --- | --- |
| **Reason for change:** | For NB-IoT in clause 16.4.2, the condition when UE do not feedback HARQ-ACK are listed at the end of pseudo code. The HARQ feedback disabled indicator is not defined in TS36.213 and it may be interpreted as a separate DCI field in DCI format N1. Thus, we would suggest to refer to TS36.212. |
|  |  |
| **Summary of change:** | Clarify the meaning of HARQ feedback disabled indicator is as defined in clause 6.4.3.2 of [TS36.212]. |
|  |  |
| **Consequences if not approved:** | A NB-IoT UE in a NTN serving cell may regard the HARQ feedback disabled indicator as a separate DCI field in DCI format N1. |

TS36.213

16.4.2 UE procedure for reporting ACK/NACK

The UE shall upon detection of a NPDSCH transmission ending in NB-IoT subframe *n* intended for the UE and for which an ACK/NACK shall be provided, start, after the end of

<Unchanged parts are omitted>

except if the UE is in a NTN serving cell, and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for all HARQ process(es) associated with transport block(s) in the NPDSCH, or the HARQ feedback disabled indicator (defined in clause 6.4.3.2 of [TS36.212]) is present in the NPDCCH corresponding to the NPDSCH.

<Unchanged parts are omitted>

TP 3-2a Specturm R1-2309000

|  |  |
| --- | --- |
| **Reason for change:** | It was agreed that 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, one common state is used for all UEs. 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. Therefore, the state of indication of HARQ feedback disabled need to be captured in 16.4.2 in 36.213. |
|  |  |
| **Summary of change:** | Section 16.4.2 in 36.213: Clarify the state of indication of HARQ feedback disabled. |
|  |  |
| **Consequences if not approved:** | The state of indication of HARQ feedback disabled is not clear. |

TS36.213

16.4.2 UE procedure for reporting ACK/NACK

\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*

except if the UE is in a NTN serving cell, and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for all HARQ process(es) associated with transport block(s) in the NPDSCH, or the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and the value of the HARQ-ACK resource field in the DCI format N1 of the corresponding NPDCCH is set to ‘15’.

\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*

TP 3-3a Nokia R1-2309651

TS36.213

- For 

- if the UE is configured with higher layer parameter *harq-AckBundling* in *npdsch-MultiTB-Config*, and the NPDSCH corresponding to a NPDCCH with DCI CRC scrambled by C-RNTI,

- if the UE is in a NTN serving cell and if the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the NPDSCH, the UE shall generate an ACK for HARQ-ACK corresponding to the transport block

- the ACK/NACK response is generated by performing a logical AND operation of HARQ-ACKs corresponding to the TB*r+*1 ,

- otherwise,

<Unchanged parts are omitted>

except if the UE is in a NTN serving cell, and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for all HARQ process(es) associated with transport block(s) in the NPDSCH, or the UE is configured with higher layer parameter downlinkHARQ-FeedbackDisabled-DCI-NB and the value of the HARQ-ACK resource field in the DCI format N1 of the corresponding NPDCCH is set to ‘15’.

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

TP 3-4a Ericsson R1-2309888

TS36.213

except if the UE is in a NTN serving cell, and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for all HARQ process(es) associated with transport block(s) in the NPDSCH, or if the UE is configured with the higher layer parameter(s) *downlinkHARQ-FeedbackDisabled-DCI-NB* or both *downlinkHARQ-FeedbackDisabled-Bitmap-NB* and *downlinkHARQ-FeedbackDisabled-DCI-NB* and the value of the HARQ-ACK resource field in the DCI format N1 in the corresponding to the NPDCCH is set to ‘15’.

Since in TS36.212, there is clear specification of the DCI states (e.g., state of “15” for HARQ-related field) and the corresponding condition on presence of the HARQ feedback disabled indicator, it seems no need for duplicated specification in TS36.213 anymore. Based on the TP from Huawei in R1-2308911, the moderator proposes the following TP for baseline discussion.

TP 3-5a Moderator

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

TS36.213

16.4.2 UE procedure for reporting ACK/NACK

The UE shall upon detection of a NPDSCH transmission ending in NB-IoT subframe *n* intended for the UE and for which an ACK/NACK shall be provided, start, after the end of

<Unchanged parts are omitted>

except if the UE is in a NTN serving cell, and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for all HARQ process(es) associated with transport block(s) in the NPDSCH, or the HARQ feedback disabled indicator is present in DCI format N1 in the NPDCCH corresponding to the NPDSCH.

<Unchanged parts are omitted>

Question: do you think the current spec in TS36.213 v18.0.0 is clear enough in three HARQ feedback disabled indication schemes for NB-IoT, if not, do you agree with any TPs (e.g., TP 3-1a Huawei, … or TP 3-5a Moderator) above?

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | Companies’ intention seems to be the same, mainly having a similar description for LTE-MTC and NB-IoT, since the latter is missing to mention the HARQ-ACK resource field state (i.e., 15) that refers to the indication of HARQ feedback disabled. More discussion is needed aiming at making converge the proposed TPs into one. |
| Nordic | Spec is clear to us. |
| Huawei, HiSilicon | As commented in section 3, the writing style is not consistent with other part of spec. |
| MediaTek | No need to further clarify. It has been specified in TS 36.212 for the HARQ feedback disabled indicator: “If downlinkHARQ-FeedbackDisabled-DCI-NB is configured, or if downlinkHARQ-FeedbackDisabled-Bitmap-NB and downlinkHARQ-FeedbackDisabled-DCI-NB are configured, and the value is ‘15’, it functions as a HARQ feedback disabled indicator.” |
| Lenovo | See comment in section 3. |
| Nokia, NSB | We think that for the last case of this part, it should be clear that DCI based disabling is configured and the field is “15”, which will make the spec clear and accurate. |

# [Active] Clarification of HARQ timing for HARQ bundling cases.

As commented by [OPPO], Regarding “*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*”, there are two understandings:

* Understanding 1: HARQ-ACK resource/HARQ timing for a TB with HARQ feedback enabled configuration reuses the legacy HARQ-ACK resource/HARQ timing adopted for the same TB.
* Understanding 2: HARQ-ACK resource/HARQ timing for a TB with HARQ feedback enabled configuration uses a HARQ-ACK resource/HARQ timing by only considering the order of HARQ feedback enabled TBs.

The above two understandings would lead to different HARQ-ACK resource determination.

Question: do you think the current agreement and spec in TS36.213 is clear enough in HARQ timing for HARQ bundling case, if not, do you agree the following clarification conclusion without any specification change.

**[Proposal 4-1a]:**

**Conclusion**

For LTE-MTC/NB-IoT with mixed HARQ feedback enabled/disabled scheduling without HARQ-ACK bundling, it implies that the HARQ-ACK resource originally adopted for TB with HARQ feedback disabled configuration with Rel.17 HARQ timing mechanism can be used for following TBs with HARQ feedback enabled configuration.

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | In our understanding “*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*”, has already been addressed in sections 10.2 and 16.4.2 for LTE-MTC and NB-IoT respectively. |
| Nordic | Understanding 2 is our understanding based on previous discussion. |
| Huawei, HiSilicon | The current spec is understanding 2. |
| MediaTek | Not support conclusion, we support understanding 2 and it has been captured in spec. |
| Lenovo | The current spec is understanding 2. We are also OK with the conclusion. |
| SONY | We have the “understanding 2” understanding. We think that the current spec supports understanding 2. |
| Nokia, NSB | Agree |

# [Active] Clarification of HARQ timing for multiple TB for CEMode B

As proposed by [Lenovo, Ericsson], the enhanced HARQ timing for CEMode B is not captured in current TS36.213 v18.0.0.

TP5-1a Lenovo R1-2309794

|  |  |
| --- | --- |
| **Reason for change:** | For FDD, the HARQ timing for multiple TBs scheduling for UE configured with CEMode B is missing. |
|  |  |
| **Summary of change:** | Add the UE configured with CEMode A, or configured with CEMode B and not configured with *downlinkHARQ-FeedbackDisabled-DCI* for the HARQ timing determination in Clause 10.2 |
|  |  |
| **Consequences if not approved:** | HARQ timing in FDD for multiple TBs scheduling is incomplete according to the agreement |

TS36.213 TP

## 10.2 Uplink HARQ-ACK timing

For TDD or for FDD-TDD and primary cell frame structure type 2 or for FDD-TDD and primary cell frame structure type 1, if a UE configured with *EIMTA-MainConfigServCell-r12* for a serving cell, "UL/DL configuration" of the serving cell in Clause 10.2 refers to the UL/DL configuration given by the parameter *eimta-HARQ-ReferenceConfig-r12* for the serving cell unless specified otherwise.

<Unchanged parts are omitted>

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

-  is the number of scheduled TB associated with HARQ processes with enabled HARQ-ACK information and with TB indices in increasing order denoted by

<Unchanged parts are omitted>

Question: do you think the current the enhanced HARQ timing for CEMode B is not captured in TS36.213, if so, do you agree with TP (e.g., TP5-1a) proposed by Lenovo in R1-2309794.

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | The procedure is missing in Terrestrial Networks (TN), thus the correction has to be performed first in TN, then the correction can be inherited for NTN. Thus, this should be discussed first under Agenda Item 6. |
| Nordic | We were wondering the same, does this change TN behaviour? |
| Huawei, HiSilicon | Agree with Ericsson. At least the first change should be performed in TN. |
| Lenovo | We are OK with the CR which is aligned with the current agreement. |
| Nokia, NSB | We do not think this update is needed. For CEmodeB, we should reuse legacy specification but not add new behavior. |

# [Active] Clarification of cases that UE not providing HARQ-ACK

As commented by [OPPO], it is not clear when the condition, i.e., the UE shall not provide HARQ-ACK for a HARQ process associated with a transport block in the PDSCH, will be satisfied in TS.36.213.

TP6-1a OPPO R1-2309600

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

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

**7.1 UE procedure for receiving the physical downlink shared channel**

<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, or the UE configured with CEModeB and higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI* and the HARQ feedback disabled indicator is present in the DCI format 6-1B of the corresponding MPDCCH, the UE shall not provide HARQ-ACK for the HARQ process associated with the transport block in the PDSCH.

For a BL/CE UE in a NTN FDD serving cell with a PDSCH ending in subframe *n*, and the UE configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* or higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI*, if the UE shall not provide HARQ-ACK for a HARQ process associated with a transport block in the PDSCH, the UE is not expected to receive a MPDCCH or a PDSCH without a corresponding MPDCCH for the same HARQ process as the PDSCH ending in subframe *n* in any BL/CE DL subframe starting from subframe *n*+1 to subframe *n*+3.

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

Question: Do you agree the need of the clarification of the cases that UE not providing HARQ-ACK, if so, do you agree the TP6-1a proposed by OPPO in R1-2309600.

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | It depends on the resolution in previous TPs, since the logic used to write the current version of the specification and the proposed clarification may already cover the intention of this TP. We can discuss after having progressed on the other TPs. |
| Nordic | OK |
| Huawei, HiSilicon | In current eMTC spec, only the conditions to feedback HARQ-ACK is provided. The rest can be regarded as no feedback. Maybe we should keep consistent writing style for TN and NTN. |
| SONY | While we have some sympathy with the comment from Huawei, I think we should say what happens when HARQ is disabled in this case. The default assumption (from the rest of the specification) is that HARQ-ACK is transmitted, hence we need to provide some “escape text” to state that that default assumption doesn’t apply when HARQ is disabled. |

# [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).

TP7-1a Nokia R1-2309651

|  |  |
| --- | --- |
| **Reason for change:** | In order to maintain a consistent index for HARQ-ACK timing in eMTC with multi-TB scheduling when HARQ-ACK bundling is not configured, no need to define tb and it should change back to original . |
|  |  |
| **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 higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating disabled HARQ-ACK information for a HARQ process associated with a transport block in the PDSCH

- *NTB* 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;

<Unchanged parts are omitted>

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

- 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;

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

Question: From moderator’s understanding the TB index in PDSCH includes TB both with HARQ feedback enabled information and with disabled information in red part of TS36.213. Do you agree the need of the clarification of TB index for HARQ timing for multiple TBs, if so, do you agree the TP7-1a proposed by Nokia in R1-2309651?

* is the last subframe in which the PDSCH containing TB is transmitted;

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | Our understanding of this TP is that it doesn’t provide a correction or a clarification, but rather a simplification. Perhaps we can prioritize discussing TPs that are aiming to clarify/correct aspects that are unclear/ambiguous/incomplete. |
| Nordic | current text is clear to us |
| Nokia, NSB | As we mentioned in the contribution, we should notice that the index of the legacy text corresponds to scheduled TB “for which an HARQ-ACK shall be provided.” 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).  In order to maintain a consistent index for HARQ-ACK timing in eMTC with multi-TB scheduling when HARQ-ACK bundling is not configured, no need to define tb and it should change back to original . |

# [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.

TP8-1a Lenovo R1-2309794

|  |  |
| --- | --- |
| **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#2 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 the need of the clarification that 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, if so, do you agree the TP8-1a proposed by Lenovo in R1-2309794.

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | In our understanding there is no issue, please note that the statements that supposedly are causing a problem are written under a Main statement saying “… 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. |
| Nordic | “UE is expected to transmit HARQ-ACK for the *W* PDSCH” already takes into account only the HARQ processes with feedback enabled. Not sure there is need for change. |
| Huawei, Hisilicon | It seems an optimization. |
| Lenovo | We think the classification of maximal PDSCH number restriction is needed. If there are only 2 HARQ process configured as enabled (HARQ process 0 and HARQ process 1). Before the uplink subframe of subframe 15 in the figure, only 2 TB can be scheduled for which HARQ-ACK shall be provided, otherwise if we don’t update the maximal PDSCH number restriction of legacy W=10, it implies that the following PDSCH scheduling will be allowed in subframe 11 and subframe 12 (e.g., corresponding HARQ-ACK feedback in subframe 16). Obviously, the above UE behavior is not aligned with the HD-FDD HARQ bundling design. |
| SONY | We are not comfortable with this change at the moment. We would like this to be revisited. |
| Nokia, NSB | We think the legacy spec can also work. |

# [Active] Clarification of mixed HARQ scheduling for eMTC and NB-IoT

As commented by [Nokia, Ericsson], condition for reporting HARQ-ACK in NB-IoT multi-TB scheduling is not correct, and a misplacement of a sentence that makes unclear the mixed case in the Multi-TB grant related procedure.

TP 9-1a Nokia R1-2309651

|  |  |
| --- | --- |
| **Reason for change:** | (1) Condition for reporting HARQ-ACK in NB-IoT multi-TB scheduling is not correct, (2) DCI indication for NB-IoT HARQ feedback disabling (when the DCI based disabling is configured) are not implemented precisely according to the agreements |
|  |  |
| **Summary of change:** | (1) Specify HARQ-ACK is reported when there exists at least one TB associated with a HARQ feedback enabled process in NB-IoT multi-TB scheduling and with the HARQ bitmap configured. (2) Explicitly specify how HARQ feedback disabling is indicated by DCI if the DCI-based HARQ feedback disabling is configured as “UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB*”. |
|  |  |
| **Consequences if not approved:** | Lax and insufficient specification for the required UE behavior. |

TS36.213

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

The UE shall upon detection of a NPDSCH transmission ending in NB-IoT subframe *n* intended for the UE and for which an ACK/NACK shall be provided, start, after the end of

<Unchanged parts are omitted>

- the value of  is the number of slots of the resource unit (defined in clause 10.1.2.3 of [3]), and

- if the UE is configured with higher layer parameter *harq-ACK-Bundling* in *npdsch-MultiTB-Config*, or if the UE is in a NTN serving cell and multiple TB are scheduled in the NPDCCH corresponding to the NPDSCH and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating enabled HARQ-ACK information for only one HARQ process associated with a transport block in the NPDSCH, then , otherwise , where the value of is determined by the Number of scheduled TB for Unicast field if present in the NPDCCH corresponding to the NPDSCH, otherwise ,

TP9-2a Ericsson R1-2309888

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

## 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, if the UE is configured with CEModeA, and if the UE is configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI format 6-1A with CRC scrambled by C-RNTI,

- for the UE in a NTN FDD serving cell, if the UE is configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap* indicating enabled HARQ-ACK information for at least one TB and indicating disabled HARQ-ACK information for at least one TB of the HARQ processes associated with a transport block of the multiple TB, the UE shall generate an ACK for HARQ-ACK corresponding to the transport block associated with the HARQ process with disabled HARQ-ACK information;

- for HARQ-ACK transmission associated with the corresponding DCI, the UE shall generate *M* HARQ-ACK bits by performing a logical AND operation of HARQ-ACKs across all TBs in each TB bundle where *b* = 1, …, *M*;

- the set of TBs that belong to TB bundle and the number of TB bundles *M* are given by Table 7.3-1;

- the value of is the number of scheduled TB determined in the corresponding DCI.

<Unchanged parts are omitted>

TPx-3a Ericsson R1-2309888

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

### 16.4.2 UE procedure for reporting ACK/NACK

The UE shall upon detection of a NPDSCH transmission ending in NB-IoT subframe *n* intended for the UE and for which an ACK/NACK shall be provided, start, after the end of

<Unchanged parts are omitted>

- if the UE is configured with higher layer parameter *harq-ACK-Bundling* in *npdsch-MultiTB-Config*, or if the UE is in a NTN serving cell and multiple TB are scheduled in the NPDCCH corresponding to the NPDSCH and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating enabled HARQ-ACK information for at least one TB and indicating disabled HARQ-ACK information for at least one TB of the HARQ processes associated with a transport block in the NPDSCH, then , otherwise , where the value of is determined by the Number of scheduled TB for Unicast field if present in the NPDCCH corresponding to the NPDSCH, otherwise ,

<Unchanged parts are omitted>

- For 

- if the UE is configured with higher layer parameter *harq-AckBundling* in *npdsch-MultiTB-Config*, and the NPDSCH corresponding to a NPDCCH with DCI CRC scrambled by C-RNTI,

- if the UE is in a NTN serving cell and if the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating enabled HARQ-ACK information for at least one TB and indicating disabled HARQ-ACK information for at least one TB of the HARQ processes associated with a transport block in the NPDSCH, the UE shall generate an ACK for HARQ-ACK corresponding to the transport block

- the ACK/NACK response is generated by performing a logical AND operation of HARQ-ACKs corresponding to the TB*r+*1 ,

<Unchanged parts are omitted>

Question: from the moderator’s understanding, for NB-IoT, the all HARQ process(es) with disabled HARQ-ACK information has been excluded in the TS36.213 clause 16.4.2 UE procedure for reporting ACK/NACK as shown in red part, so in the mixed HARQ scheduling text, it implies that at least one TB is associated with enabled HARQ-ACK information implicitly. Similar text can be found in eMTC spec. So do you agree with clarification of mixed case in the multi-TB grant related procedure, if so, do you agree the TP9-1a to TP9-3a?

* except if the UE is in a NTN serving cell, and the UE is not configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-DCI-NB* and configured with higher layer parameter *downlinkHARQ-FeedbackDisabled-Bitmap-NB* indicating disabled HARQ-ACK information for all HARQ process(es) associated with transport block(s) in the NPDSCH, or the HARQ feedback disabled indicator is present in the NPDCCH corresponding to the NPDSCH.

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | The misplacement of a sentence in clause 7.3 needs to be corrected, whereas in both clauses 7.3 and 16.4.2 the mixed case should be made clear not to only explicitly mentioning that there is a HARQ process with HARQ feedback disabled, but also that there is at least one HARQ process with HARQ feedback enabled as to reflect the mixed cases. |
| Nordic | N\_TB should be regarded as TBs with HARQ enabled. So if N\_TB =0, then no feedback. |
| Huawei, HiSilicon | TP9-1a seems just reverse the description. If a clarification is really necessary, TP9-2a is better. But the wording “at least one TB” may cause confusion. As NB only support 2 TB, if one is disabled then the other is enable. |
| MediaTek | Current spec has captured mixed HARQ scheduling, but we are fine to make it clearer. |
| Lenovo | We think the current spec is clear enough. |
| Nokia, NSB | We think this is a special case, when only one TB is remained as feedback enabled, then  RAN1 spec should be update accordingly. |

# [Active] NPDCCH monitoring restriction for NB-IoT NTN with HARQ feedback enabled

As commented by [MTK], For the NPDCCH monitoring restriction in this blind retransmission mechanism, the minimum monitoring restriction can be considered as 1ms, similar to the minimum time between the end of NPUSCH transmission and the start of NPDCCH monitoring for an UL HARQ process with HARQ mode B.

Question: From moderator’s understanding, the above NPDCCH monitoring restriction procedure has been captured in TS36.213 clause 16.6 in red part. Do you agree to further clarify the NPDCCH monitoring restriction for NB-IoT NTN with HARQ feedback enabled?

* 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

Please provide your views and comments.

|  |  |
| --- | --- |
| **Company** | **Comments and Views** |
| Ericsson | In our understanding the above is already captured in clause 16.6. |
| Huawei, HiSilicon | Agree with FL’s assessment. |
| MediaTek | Since there is spec impact to RAN2, a conclusion can be made. |
| Lenovo | The above NPDCCH monitoring restriction has been captured in 16.6 |
| Nokia, NSB | We agree with moderator, legacy spec can be reused and no need for update. |

# [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.

However, proposed by [Ericsson], for LTE-MTC the “Value Range” for bitmap is up to 14-bits and while for NB-IoT the “Value Range” for bitmap is up to 2-bits.

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 | Yes, RAN2 will decide on the design.  Thus, for this topic we just need to add in the next update of the “Consolidated higher layer parameters list for Rel18,” the missing “Notes” from RAN1# 114 (which is basically a guidance on what they have to account for, see the wording “up to”):  • In row 2, column P (i.e., comment field) the following is missing to be captured: “For LTE-MTC the “Value Range” for bitmap is up to 14-bits”.  • In row 3, column P (i.e., comment field) the following is missing to be captured: “For NB-IoT the “Value Range” for bitmap is up to 2-bits”. |
| Nordic | We can recommend to RAN2 that 2 and 14 bits, respectively, but final RRC design up to RAN2. |
| Huawei, HiSilicon | In NR NTN, the size of bitmap is not changed with the number of configured HARQ process. Similar design can be used in IoT NTN. as the parameter is introduced by RAN1, we should provide sufficient information on how the parameter should looks like. |
| Lenovo | OK to leave it to RAN2 discussion |
| Nokia, NSB | We agree with moderator. The remaining RRC parameter can be up to RAN2. |

# 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.

|  |  |  |
| --- | --- | --- |
| **Company** | **Delegate(s) name**  **(Given name, Family name)** | **Email** |
| Ericsson | Gerardo Agni, Medina Acosta | [gerardo.agni.medina.acosta@ericsson.com](mailto:gerardo.agni.medina.acosta@ericsson.com) |
| Apple | Chunxuan Ye | [Chunxuan\_ye@apple.com](mailto:Chunxuan_ye@apple.com) |
| Apple | Chunhai Yao | [Chunhai\_yao@apple.com](mailto:Chunhai_yao@apple.com) |
| CATT | Deshan Miao | [miaodeshan@catt.cn](mailto:miaodeshan@catt.cn) |
| Nordic | Karol Schober | [karol.schober@nordicsemi.no](mailto:karol.schober@nordicsemi.no) |
| MediaTek | Wen Tang | [WenT.Tang@mediatek.com](mailto:WenT.Tang@mediatek.com) |
| Mavenir | Sina Khoshabi-Nobar | [sina.khoshabinobar@mavenir.com](mailto:sina.khoshabinobar@mavenir.com) |
| Spreadtrum | Zhenzhu lei | [reven.lei@unisoc.com](mailto:reven.lei@unisoc.com) |
| Lockheed Martin | Robert Olesen | [robert.l.olesen@lmco.com](mailto:robert.l.olesen@lmco.com) |
| Xiaomi | Yajun Zhu | [zhuyajun@xiaomi.com](mailto:zhuyajun@xiaomi.com) |
| CMCC | Wei Qin | [qinwei@chinamobile.com](mailto:qinwei@chinamobile.com) |
| NEC | Xincai Li | li\_xincai@nec.cn |
| Sharp | Hiro Takahashi | [takahashi.hiroki@sharp.co.jp](mailto:yingk@sharplabs.com) |
| Sharp | Toshi Nogami | [nogami.toshizoh@sharp.co.jp](mailto:nogami.toshizoh@sharp.co.jp) |
| Samsung | Carmela Cozzo | [carmela.c@samsung.com](mailto:carmela.c@samsung.com) |
| Nokia, NSB | Jingyuan Sun | [Jingyuan.sun@nokia-sbell.com](mailto:Jingyuan.sun@nokia-sbell.com) |
| ZTE | Fangyu Cui | [cui.fangyu@zte.com.cn](mailto:cui.fangyu@zte.com.cn) |
| Qualcomm | Ayan Sengupta | [asengupt@qti.qualcomm.com](mailto:asengupt@qti.qualcomm.com) |
| Lenovo | Zhi Yan | [yanzhi1@lenovo.com](mailto:yanzhi1@lenovo.com) |
| OPPO | Hao Lin | [lin.hao@oppo.com](mailto:lin.hao@oppo.com) |
| OPPO | Zuomin Wu | wuzuomin@oppo.com |
| Huawei, HiSilicon | Jiayin Zhang | [zhangjiayin@huawei.com](mailto:zhangjiayin@huawei.com) |
| Huawei, HiSilicon | Xiaolei Tie | tiexiaolei@huawei.com |
| InterDigital | Moon-il Lee | Moonil.lee@interdigital.com |
| Sequans | Efstathios Katranaras | [ekatranaras@sequans.com](mailto:ekatranaras@sequans.com) |
| Qualcomm | Alberto Rico | [albertor@qti.qualcomm.com](mailto:albertor@qti.qualcomm.com) |
| SONY | Hiroki Matsuda | [hiroki.matsuda@sony.com](mailto:hiroki.matsuda@sony.com) |
| SONY | Martin Beale | martin.beale@sony.com |

# References

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