**3GPP T****SG-RAN WG2 Meeting #124 [draft]R2-2313783**

**Chicago, USA: November 13-17, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.306** | **CR** | **1872** | **rev** | **1** | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of Rel-18 IoT NTN UE capabilities | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Inc. | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | IoT\_NTN\_enh-Core | | | | |  | ***Date:*** | | | 2023-11-03 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)*  *Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To add new UE feature and capabilities based on Rel-18 IoT NTN agreements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | UE capability information on the following features are captured:   * Event A4 for CHO for eMTC * Location-based CHO for eMTC * Time-based CHO for eMTC * HARQ feedback enable/disable * GNSS fix in connected mode * UL HARQ mode B * Location-based measurement initiation in IDLE mode * Time and location based measurement trigger in connected mode * UL TX extension on GNSS validity expiry * Support of GNSS and HARQ enhancements in NGSO | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | UE capabilities for Rel-18 IoT NTN features will not be captured. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.3.38, 6.19 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **Y** |  | Other core specifications | | | | TS 36.331 CR xxxx | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS 36.304 CR xxxx | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS 36.321 CR xxxx  TS 36.300 CR xxxx | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Revision of R2-2312281 | | | | | | | | |

START OF CHANGE

4.3.38 IoT NTN parameters

4.3.38.1 *ntn-Connectivity-EPC-r17*

This field indicates whether the UE supports NTN access. This field is only applicable if the UE supports *ce-ModeA-r13* or any *ue-Category-NB*. If the UE indicates this capability the UE shall support the following enhancements:

- General:

- handling of *cellBarred-NTN-r17* and *trackingAreaList-r17* in *SystemInformationBlockType1(-NB)* as specified in TS 36.331 [5];

- reception of *SystemInformationBlockType31(-NB)* as specified in TS 36.331 [5];

- derivation of its position based on its GNSS measurements;

- reporting of the remaining GNSS validity duration as specified in TS 36.331 [5];

- PDCP:

- if the UE supports *ce-ModeA-r13, discardTimerExt-r17* as specified in TS 36.331 [5];

- RLC:

- *t-ReorderingExt-r17* as specified in TS 36.331 [5];

- MAC:

- estimation of UE-gNB RTT as specified in TS 36.321 [4];

- delaying the start of the RA response window as specified in TS 36.321 [4];

*-* delaying the start of the *mac-ContentionResolutionTimer* as specified in TS 36.321 [4];

- if the UE supports *ce-ModeA-r13* orif the UE supports any *ue-Category-NB* and supports *sr-WithoutHARQ-ACK-r15,* handling of *sr-ProhibitTimerOffset-r17* as specified in TS 36.331 [5];

- extending the length of the (UL) HARQ RTT timer as specified in TS 36.321 [4];

- Physical layer:

- calculation of the UE specific TA in RRC\_IDLE and RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris as specified in TS 36.211 [17];

- calculation of the common TA in RRC\_IDLE and RRC\_CONNECTED as specified in TS 36.213 [22];

- for TA update in RRC\_CONNECTED state, support of combination of both open (i.e. UE specific TA estimation, and common TA calculation) and closed (i.e., received TA commands) control loops;

- frequency pre-compensation to counter shift the Doppler experienced on the service link;

- timing relationship enhancements using higher layer parameters *k-Offset-r17* and *k-Mac-r17* as specified in TS 36.213 [22];

- segmented UL transmission using higher layer parameters *prach-TxDuration-r17*, *nprach-TxDurationFmt01-r17, nprach-TxDurationFmt2-r17, pucch-TxDuration-r17* and *(n)pusch-TxDuration-r17* as specified in TS 36.331 [5] except for UEs indicating support of *ue-Category-NB* and *ntn-ScenarioSupport-r17* with value GSO.

A UE indicating support of *ce-ModeA-r13* and *ntn-Connectivity-EPC-r17* shall also indicate support of *standaloneGNSS-Location*. A UE indicating support for any *ue-Category-NB* and *ntn-Connectivity-EPC-r17* is assumed to have GNSS location capability*.*

4.3.38.2 *ntn-TA-Report-r17*

This field indicates whether the UE supports Timing advance reporting in NTN cell as specified in TS 36.321 [4]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

4.3.38.3 *ntn-PUR-TimerDelay-r17*

This field indicates whether the UE supports delaying the start of the *pur-ResponseWindowTimer* for NTN operation as specified in TS36.321 [4]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*. A UE indicating support of *ntn-PUR-TimerDelay-r17* shall also indicate support of *pur-CP-EPC-CE-ModeA-r16* or *pur-UP-EPC-CE-ModeA-r16* or *pur-CP-EPC-r16* or *pur-UP-EPC-r16.*

4.3.38.4 *ntn-OffsetTimingEnh-r17*

This field indicates whether the UE supports timing relationship enhancements using Differential Koffset as specified in TS 36.321 [4] and TS 36.213 [22]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

4.3.38.5 *ntn-ScenarioSupport-r17*

This field indicates whether the UE supports NTN features in GSO or NGSO scenario. The UE indicating support of *ntn-ScenarioSupport-r17* shall also indicate support of *ntn-Connectivity-EPC-r17*. If a UE does not include this field but includes *ntn-Connectivity-EPC-r17*, the UE supports the NTN features for both GSO and NGSO scenarios.

4.3.38.6 *ntn-SegmentedPrecompensationGaps-r17*

This field indicates the supported gap length between segments for PUSCH and PUCCH required by a UE supporting *ce-ModeA-r13* or for NPUSCH required by a UE supporting *ue-category-NB*, for TA pre-compensation. This feature is only applicable if the UE supports either *ue-category-NB* or *ce-ModeA-r13* and also supports *ntn-Connectivity-EPC-r17*. If a UE does not include this field but includes *ntn-Connectivity-EPC-r17*, in case of overlapped transmission between successive uplink segments, UE shall follow the procedure specified in TS 36.213 [22]. This field is not applicable for UEs indicating support of *ue-Category-NB* and *ntn-ScenarioSupport-r17* with value GSO.

4.3.38.x *ntn-EventA4BasedCHO-r18*

This field indicates whether the UE supports Event A4 based conditional handover, i.e., *CondEvent A4* as specified in TS 36.331 [5]. A UE supporting this feature shall also indicate the support of *cho-r16* and *ntn-Connectivity-EPC-r17.*

4.3.38.x *ntn-LocationBasedCHO-r18*

This field indicates whether the UE supports location based conditional handover, i.e., *CondEvent D1* as specified in TS 36.331 [5]. A UE supporting this feature shall also indicate the support of *cho-r16* and *ntn-Connectivity-EPC-r17.*

4.3.38.x *ntn-TimeBasedCHO-r18*

This field indicates whether the UE supports time based conditional handover, i.e., *CondEvent T1* as specified in TS 36.331 [5]. A UE supporting this feature shall also indicate the support of *cho-r16* and *ntn-Connectivity-EPC-r17.*

4.3.38.x *ntn-LocationBasedMeasTrigger-r18*

This field indicates whether the UE supports location-based measurement trigger in RRC\_CONNECTED as specified in TS 36.331 [5]. A UE supporting this feature shall also indicate the support *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-TimeBasedMeasTrigger-r18*

This field indicates whether the UE supports time-based measurement trigger in RRC\_CONNECTED as specified in TS 36.331 [5]. A UE supporting this feature shall also indicate the support *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-SemiStaticHarqFeedbackDisabledSingleTB-r18*

This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration. This feature is only applicable if the UE supports *ue-category-NB.* A UE supporting this feature shall also indicate the support of *ue-category-NB* and *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-OverriddenDynamicHarqFeedbackDisabledSingleTB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission by overriding the RRC configuration. This feature is only applicable if the UE supports *ue-category-NB.* A UE supporting this feature shall also indicate the support of *ntn-SemiStaticHarqFeedbackDisabledSingleTB-r18*.

4.3.38.x *ntn-DirectDynamicHarqFeedbackDisabledSingleTB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission when HARQ feedback disabling per HARQ process for downlink transmission is not configured by RRC. This feature is only applicable if the UE supports *ue-category-NB.* A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-SemiStaticHarqFeedbackDisabledMultiTB-r18*

This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration when configured with *npdsch-MultiTB-Config*. This feature is only applicable if the UE supports *ue-category-NB.* A UE supporting this feature shall also indicate the support of *npdsch-MultiTB-r16* and *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-OverriddenDynamicHarqFeedbackDisabledMultiTB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission by overriding the RRC configuration when configured with *npdsch-MultiTB-Config*. This feature is only applicable if the UE supports *ue-category-NB.* A UE supporting this feature shall also indicate the support of *ntn-SemiStaticHarqFeedbackDisabledSingleTB-r18*.

4.3.38.x *ntn-DirectDynamicHarqFeedbackDisabledMultiTB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission when HARQ feedback disabling per HARQ process for downlink transmission is not configured by RRC and when configured with *npdsch-MultiTB-Config*. A UE supporting this feature shall also indicate the support of *npdsch-MultiTB-r16* and *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-SemiStaticHarqFeedbackDisabledSingleTB-CE-ModeA-r18*

This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration when operating in coverage enhancement mode A. This feature is only applicable if the UE supports *ce-ModeA-r13.* A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-SemiStaticHarqFeedbackDisabledSingleTB-CE-ModeB-r18*

This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration when operating in coverage enhancement mode B. This feature is only applicable if the UE supports *ce-ModeB-r13.* A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-OverriddenDynamicHarqFeedbackDisabledSingleTB-CE-ModeB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission by overriding the RRC configuration when operating in coverage enhancement mode B. A UE supporting this feature shall also indicate the support of *ntn-SemiStaticHarqFeedbackDisabledSingleTB-CE-ModeB-r18*.

4.3.38.x *ntn-DirectDynamicHarqFeedbackDisabledSingleTB-CE-ModeB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission when HARQ feedback disabling per HARQ process for downlink transmission is not configured by RRC and operating in coverage enhancement mode B. This feature is only applicable if the UE supports *ce-ModeB-r13.* A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-SemiStaticHarqFeedbackDisabledMultiTB-CE-ModeA-r18*

This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration when operating in coverage enhancement mode A and when configured with *ce-PDSCH-MultiTB-Config*. A UE supporting this feature shall also indicate the support of *pdsch-MultiTB-CE-ModeA-r16* and *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-SemiStaticHarqFeedbackDisabledMultiTB-CE-ModeB-r18*

This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration when operating in coverage enhancement mode B and when configured with *ce-PDSCH-MultiTB-Config*. A UE supporting this feature shall also indicate the support of *pdsch-MultiTB-CE-ModeB-r16* and *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-OverriddenDynamicHarqFeedbackDisabledMultiTB-CE-ModeB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission by overriding the RRC configuration when operating in coverage enhancement mode B and when configured with *ce-PDSCH-MultiTB-Config*. A UE supporting this feature shall also indicate the support of *ntn-SemiStaticHarqFeedbackDisabledMultiTB-CE-ModeB-r18*.

4.3.38.x *ntn-DirectDynamicHarqFeedbackDisabledMultiTB-CE-ModeB-r18*

This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission when HARQ feedback disabling per HARQ process for downlink transmission is not configured by RRC and operating in coverage enhancement mode B and when configured with *ce-PDSCH-MultiTB-Config*. A UE supporting this feature shall also indicate the support of *pdsch-MultiTB-CE-ModeB-r16* and *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-SemiStaticHarqFeedbackDisabledSPS-CE-ModeA-r18*

This field indicates whether the UE supports HARQ feedback transmission for the first SPS PDSCH transmission after activation when operating in coverage enhancement mode A. A UE supporting this feature shall also indicate the support of *ce-ModeA-r13* and *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-UplinkHarq-ModeB-r18*

This field indicates whether the UE supports HARQ Mode B. This field is only applicable if the UE supports *ce-ModeA-r13* or *any ue-Category-NB*. For a UE indicating support of *ce-ModeA-r13*, this field also indicates whether the UE supports the corresponding LCP restrictions for uplink transmission. A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-HarqEnhNGSO-Support-r18*

This field indicates whether the UL and DL HARQ process enhancements that are indicated as supported are applicable in NGSO scenarios for UE indicating support of NGSO scenario or GSO and NGSO scenarios. If this field is not included, the UL and DL HARQ process enhancements that are indicated as supported are not applicable in NGSO scenario. This field is only applicable if the UE supports at least one of *ntn-SemiStaticHarqFeedbackDisabledSingleTB-r18*, *ntn-OverriddenDynamicHarqFeedbackDisabledSingleTB-r18*, *ntn-DirectDynamicHarqFeedbackDisabledSingleTB-r18*, *ntn-SemiStaticHarqFeedbackDisabledMultiTB-r18*, *ntn-OverriddenDynamicHarqFeedbackDisabledMultiTB-r18*, *ntn-DirectDynamicHarqFeedbackDisabledMultiTB-r18*, *ntn-SemiStaticHarqFeedbackDisabledSingleTB-CE-ModeA-r18*, *ntn-OverriddenDynamicHarqFeedbackDisabledSingleTB-CE-ModeA-r18*, *ntn-DirectDynamicHarqFeedbackDisabledSingleTB-CE-ModeA-r18*, *ntn-SemiStaticHarqFeedbackDisabledSingleTB-CE-ModeB-r18*, *ntn-OverriddenDynamicHarqFeedbackDisabledSingleTB-CE-ModeB-r18*, *ntn-DirectDynamicHarqFeedbackDisabledSingleTB-CE-ModeB-r18*, *ntn-SemiStaticHarqFeedbackDisabledMultiTBTB-CE-ModeA-r18*, *ntn-OverriddenDynamicHarqFeedbackDisabledMultiTB-CE-ModeA-r18*, *ntn-DirectDynamicHarqFeedbackDisabledMultiTB-CE-ModeA-r18*, *ntn-SemiStaticHarqFeedbackDisabledMultiTB-CE-ModeB-r18*, *ntn-OverriddenDynamicHarqFeedbackDisabledMultiTB-CE-ModeB-r18*, *ntn-DirectDynamicHarqFeedbackDisabledMultiTB-CE-ModeB-r18* and *ntn-UplinkHarq-ModeB-r18*.

4.3.38.x *ntn-Triggered-GNSS-Fix-r18*

This field indicates whether the UE supports network triggered GNSS fix in RRC\_CONNECTED. This field is only applicable if the UE supports *ce-ModeA-r13* or any *ue-Category-NB*. A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*. If the UE indicates this capability, the UE shall support the following enhancements:

- UE reports GNSS position fix time duration for measurement during the initial access stage, RRC resumption, and RRC reestablishment.

- if the UE supports *ce-ModeA-r13*, UE reports GNSS position fix time duration for measurement during handover.

- UE receives GNSS measurement trigger from eNB

- UE re-acquires GNSS position fix within a configured gap

- UE reports the remaining GNSS validity duration with MAC CE in RRC\_CONNECTED.

4.3.38.x *ntn-Autonomous-GNSS-Fix-r18*

This field indicates whether the UE supports autonomous GNSS fix in RRC\_CONNECTED. This field is only applicable if the UE supports *ce-ModeA-r13* or any *ue-Category-NB*. A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*. If the UE indicates this capability, the UE shall support the following enhancements:

- UE reports GNSS position fix time duration for measurement during the initial access stage, RRC resumption, and RRC reestablishment.

- if the UE supports *ce-ModeA-r13*, UE reports GNSS position fix time duration for measurement during handover.- UE re-acquires GNSS autonomously (when configured by the network) if it does not receive eNB GNSS measurement trigger

- UE reports the remaining GNSS validity duration with MAC CE in RRC\_CONNECTED.

4.3.38.x *ntn-UplinkTxExtension-r18*

This field indicates whether the UE supports to perform UL transmission in a duration X after original GNSS validity duration expires without GNSS re-acquisition when enabled by the network. This field is only applicable if the UE supports *ce-ModeA-r13* or any *ue-Category-NB*. A UE supporting this feature shall also indicate the support of *ntn-Connectivity-EPC-r17*.

4.3.38.x *ntn-GNSS-EnhNGSO-Support-r18*

This field indicates whether the GNSS measurement enhancements in RRC\_CONNECTED that are indicated as supported are applicable in NGSO scenario for UE indicating support of NGSO scenario or GSO and NGSO scenarios. If this field is not included, the GNSS measurement enhancements in RRC\_CONNECTED that are indicated as supported are not applicable in NGSO scenario. This field is only applicable if the UE supports at least one of *ntn-Triggered-GNSS-Fix-r18,* *ntn-Autonomous-GNSS-Fix-r18* and *ntn-UplinkTxExtension-r18*.

5 Void

6 Optional features without UE radio access capability parameters

Unchanged part skipped

6.19 IoT NTN Features

6.19.1 Cell reselection measurements triggering based on service time

It is optional for UE camped on NTN cell to support triggering of early cell reselection measurements based on the service time broadcasted by the cell as specified in TS 36.304 [14]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

6.19.1 Early RLF triggering based on service time

It is optional for UE in RRC\_CONNECTED to support triggering of RLF upon reaching the service time broadcasted for the serving cell as specified in TS 36.331 [5]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

6.19.x Neighbor cell measurements based on service start time of the neighbor cell

It is optional for UE camped on NTN cell to support neighbor cell measurements based on the service start time of the neighbor cell broadcasted by the serving cell as specified in TS 36.304 [14]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

6.19.2 Discontinuous coverage

It is optional for a UE camped on NTN cell to support discontinuous coverage as specified in TS 36.304 [14]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

6.19.1 UE autonomous release based on service time

It is optional for UE in RRC\_CONNECTED to go to RRC\_IDLE after RLF is triggered if the UE determines by implementation there is not enough time to finish the procedure of reestablishment due to the discontinuous coverage as specified in TS 36.331 [5]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

6.19.x Cell reselection measurements triggering based on location for fixed cell

It is optional for UE camped on NTN quasi-earth fixed cell and GSO cell to support triggering of early cell reselection measurements based on the reference location broadcasted by the cell as specified in TS 36.304 [14]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

6.19.x Cell reselection measurements triggering based on location for earth moving cell

It is optional for UE camped on NTN moving cell to support triggering of early cell reselection measurements based on the reference location and associated reference time broadcasted by the cell as specified in TS 36.304 [14]. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

6.19.1 GNSS measurements during C-DRX inactive time

It is optional for UE in RRC\_CONNECTED to perform GNSS measurements during inactive time of a C-DRX cycle. This feature is only applicable if the UE supports *ntn-Connectivity-EPC-r17*.

END OF CHANGE

Annex RAN1 feature list R1-2312569 [to be removed]

1. IoT\_NTN\_enh

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| Features | Index | | Feature group | Components | | | | | Prerequisite feature groups | | | Need for the eNB to know if the feature is supported | | | Need for the UE to know if the feature is supported (only for V2X WI, where the PC5-RRC capability signalling is delivered between the UEs) | | | **Consequence if the feature is not supported by the UE** | | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Capability interpretation for mixture of FDD/TDD | Note | Mandatory/Optional |
| 2. IoT\_NTN\_enh | 2-1a-1 | | Semi-static HARQ feedback disabling for eMTC CE mode B in single TB case | 1. UE gets RRC configuration for disabling HARQ feedback per UE per process | | | | | Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode B cannot disable HARQ feedback in single TB case | | WA: Per UE | No | No | Note: this applies to single-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1b-1 | | Dynamic HARQ feedback disabling by DCI-based direct indication for eMTC CE mode B in single TB case | 1. UE receives DCI indication to directly indicate disabling HARQ feedback | | | | | Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode B cannot disable HARQ feedback in single TB case | | WA: Per UE | No | No | Note: this applies to single-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1c-1 | | Dynamic HARQ feedback disabling by DCI-based overridden indication for eMTC CE mode B in single TB case | 1. UE receives DCI indication to override RRC configuration for disabling HARQ feedback | | | | | Rel.17 2-1,  Rel-18 2-1a-1, 2-1b-1 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode B cannot disable HARQ feedback in single TB case | | WA: Per UE | No | No | Note: this applies to single-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1a-2 | | Semi-static HARQ feedback disabling for eMTC CE mode B in multi TB case | 1. UE gets RRC configuration for disabling HARQ feedback per UE per process | | | | | Rel-16 1-11,  Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode B cannot disable HARQ feedback in multi TB case | | WA: Per UE | No | No | Note: this applies to multi-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1b-2 | | Dynamic HARQ feedback disabling by DCI-based direct indication for eMTC CE mode B in multi TB case | 1. UE receives DCI indication to directly indicate ~~/ override RRC configuration for~~ disabling HARQ feedback | | | | | Rel-16 1-11,  Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode B cannot disable HARQ feedback in multi TB case | | WA: Per UE | No | No | Note: this applies to multi-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1c-2 | | Dynamic HARQ feedback disabling by DCI-based overridden indication for eMTC CE mode B in multi TB case | 1. UE receives DCI indication to override RRC configuration for disabling HARQ feedback | | | | | Rel-16 1-11,  Rel.17 2-1,  Rel-18 2-1a-2, 2-1b-2 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode B cannot disable HARQ feedback in multi TB case | | WA: Per UE | No | No | Note: this applies to multi-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1d-1 | | Semi-static HARQ feedback disabling for eMTC CE mode A in single TB case | 1. UE gets RRC configuration for disabling HARQ feedback per UE per process | | | | | Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode A cannot disable HARQ feedback in single TB case | | WA: Per UE | No | No | Note: this applies to single-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1d-2 | | Semi-static HARQ feedback disabling for eMTC CE mode A in multi TB case | 1. UE gets RRC configuration for disabling HARQ feedback per UE per process | | | | | Rel-16 1-10,  Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE with CE mode A cannot disable HARQ feedback in multi TB case | | WA: Per UE | No | No | Note: this applies to multi-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-2 | | Semi-static HARQ feedback disabling for SPS PDSCH for eMTC CE Mode A | UE reports ACK/NACK for the first SPS PDSCH after activation if enabled, and follow per-process HARQ feedback enabled/disabled configuration otherwise | | | | | Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE Mode A cannot disable HARQ feedback for SPS PDSCH | | WA: Per UE | No | No |  | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1e-1 | | Semi-static HARQ feedback disabling for NB-IoT in single TB case | 1. UE gets RRC configuration for disabling HARQ feedback per UE per process | | | | | Rel. 17 2-1b | | | Yes | | | N/A | | | Release 18 NB-IoT UE cannot disable HARQ feedback in single TB case | | WA: Per UE | No | No | Note: this applies to single-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1f-1 | | Dynamic HARQ feedback disabling by DCI-based direct indication for NB-IoT in single TB case | 1. UE receives DCI indication to directly indicate disabling HARQ feedback | | | | | Rel. 17 2-1b | | | Yes | | | N/A | | | Release 18 NB-IoT UE cannot disable HARQ feedback in single TB case | | WA: Per UE | No | No | Note: this applies to single-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1g-1 | | Dynamic HARQ feedback disabling by DCI-based overridden indication for NB-IoT in single 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 | | | | | Rel. 17 2-1b, Rel-18 2-1e-1, 2-1f-1 | | | Yes | | | N/A | | | Release 18 NB-IoT UE cannot disable HARQ feedback in single TB case | | WA: Per UE | No | No | Note: this applies to single-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1e-2 | | Semi-static HARQ feedback disabling for NB-IoT in multi TB case | 1. UE gets RRC configuration for disabling HARQ feedback per UE per process | | | | | At least one of {Rel-16 2-6, 2-7},  Rel. 17 2-1b | | | Yes | | | N/A | | | Release 18 NB-IoT UE cannot disable HARQ feedback in multi TB case | | WA: Per UE | No | No | Note: this applies to multi-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-1f-2 | | Dynamic HARQ feedback disabling by DCI-based direct indication for NB-IoT in multi TB case | 1. UE receives DCI indication to directly indicate for disabling HARQ feedback | | | | | At least one of {Rel-16 2-6, 2-7},  Rel. 17 2-1b | | | Yes | | | N/A | | | Release 18 NB-IoT UE cannot disable HARQ feedback in multi TB case | | WA: Per UE | No | No | Note: this applies to multi-TB case | Optional with capability signalling |
| 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 2-1b,  Rel-18 2-1e-2, 2-1f-2 | | | Yes | | | N/A | | | Release 18 NB-IoT UE cannot disable HARQ feedback in multi TB case | | WA: Per UE | No | No | Note: this applies to multi-TB case | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-3a | | GNSS position fix in RRC Connected state for eMTC—triggered | 1. UE reports GNSS position fix time duration for measurement at least during the initial access stage and in connected mode via RRCConnectionReestablishmentComplete and RRCConnectionReconfigurationComplete for HO case  2. UE receives eNB GNSS measurement trigger  4. UE re-acquires GNSS position fix within a configured gap  5. UE reports the remaining GNSS validity duration with MAC CE in connected mode | | | | | Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE cannot get triggered GNSS position fix in RRC Connected state | | WA: Per UE | No | No | Note: This applies to non-DRX | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-4a | | GNSS position fix in RRC Connected state for eMTC—autonomous | 1. UE re-acquires GNSS autonomously (when configured by the network) if it does not receive eNB GNSS measurement trigger  2. UE reports GNSS position fix time duration for measurement at least during the initial access stage and in connected mode via RRCConnectionReestablishmentComplete and RRCConnectionReconfigurationComplete for HO case  3. UE reports the remaining GNSS validity duration with MAC CE in connected mode | | | | | [Rel. 18 2-3a] Rel. 17 2-1 | | | Yes | | | N/A | | | Release 18 eMTC UE cannot get autonomous GNSS position fix in RRC Connected state | | WA: Per UE | No | No | Note: This applies to non-DRX | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-3b | | GNSS position fix in RRC Connected state for NB-IoT—triggered | 1. UE reports GNSS position fix time duration for measurement at least during the initial access stage and in connected mode via RRCConnectionReestablishmentComplete-NB  2. UE receives eNB GNSS measurement trigger  4. UE re-acquires GNSS position fix within a configured gap  5. UE reports the remaining GNSS validity duration with MAC CE in connected mode | | | | | Rel. 17 2-1b | | | Yes | | | N/A | | | Release 18 NB-IoT UE cannot get triggered GNSS position fix in RRC Connected state | | WA: Per UE | No | No | Note: This applies to non-DRX | Optional with capability signalling |
| 2. IoT\_NTN\_enh | 2-4b | | GNSS position fix in RRC Connected state for NB-IoT—autonomous | 1. UE re-acquires GNSS autonomously (when configured by the network) if it does not receive eNB GNSS measurement trigger  2. UE reports GNSS position fix time duration for measurement at least during the initial access stage and in connected mode via RRCConnectionReestablishmentComplete-NB  3. UE reports the remaining GNSS validity duration with MAC CE in connected mode | | | | | [Rel. 18 2-3b], Rel. 17 2-1b | | |  | | |  | | | Release 18 NB-IoT UE cannot get autonomous GNSS position fix in RRC Connected state | | WA: Per UE | No | No | Note: This applies to non-DRX | Optional with capability signalling |
| 2. IoT\_NTN\_enh | | 2-5a | UL transmission extension after original validity duration expires for eMTC | | 1. UE is allowed to transmit UL in a duration X after original GNSS validity duration expires without GNSS re-acquisition when enabled by the network | Rel. 17 2-1 | Yes | N/A | | Release 18 eMTC UE cannot get UL extension in RRC Connected state | WA: Per UE | | No | No | |  | Optional with capability signalling | |
| 2. IoT\_NTN\_enh | | 2-5b | UL transmission extension after original validity duration expires for NB-IoT | | 1. UE is allowed to transmit UL in a duration X after original GNSS validity duration expires without GNSS re-acquisition when enabled by the network | Rel. 17 2-1b | Yes | N/A | | Release 18 NB-IoT UE cannot get UL extension in RRC Connected state | WA: Per UE | | No | No | |  | Optional with capability signalling | |
| 2. IoT\_NTN\_enh | | 2-2a | NGSO for HARQ disabling for eMTC | | Support of NGSO for HARQ disabling for eMTC | At least one of 2-1a-1  2-1b-1  2-1c-1  2-1a-2  2-1b-2  2-1c-2  2-1d-1  2-1d-2  2-2 | Yes | N/A | | NGSO is not supported for HARQ disabling for eMTC | WA: Per UE | | No | No | | This row/FG is a WA | Optional with capability signaling | |
| 2. IoT\_NTN\_enh | | 2-2b | NGSO for HARQ disabling for NB-IoT | | Support of NGSO for HARQ disabling for NB-IoT | At least one of 2-1e-1  2-1f-1  2-1g-1  2-1e-2  2-1f-2  2-1g-2 | Yes | N/A | | NGSO is not supported for HARQ disabling for NB-IoT | WA: Per UE | | No | No | | This row/FG is a WA | Optional with capability signaling | |
| 2. IoT\_NTN\_enh | | 2-6a | NGSO for GNSS enhancements for eMTC | | Support of NGSO for GNSS enhancements for eMTC | At least one of 2-3a, 2-4a, 2-5a | Yes | N/A | | NGSO for GNSS enhancements for eMTC is not supported | WA: Per UE | | No | No | | This row/FG is a WA | Optional with capability signaling | |
| 2. IoT\_NTN\_enh | | 2-6b | NGSO for GNSS enhancements for NB-IoT | | Support of NGSO for GNSS enhancements for NB-IoT | At least one of 2-3b, 2-4b, 2-5b | Yes | N/A | | NGSO for GNSS enhancements for NB-IoT is not supported | WA: Per UE | | No | No | | This row/FG is a WA | Optional with capability signaling | |