**3GPP TSG- Meeting #7 *R2-2407620***

**Masstricht, Netherlands, Aug 19th – 23rd, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** | **1588** | **rev** | **1** | **Current version:** |  |  |
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| *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:*** | Miscellaneous MAC correction for IoT NTN | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
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| ***Work item code:*** |  | | | | |  | ***Date:*** | | | 2024-08-19 |
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| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
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| ***Reason for change:*** | | <1> In current spec, UE can autonomously trigger GNSS measurement during the inactive period of C-DRX and most of the detailed behaviour is left to UE implementation. Moreover, if T390 (timer for UL transmission extension) is running when the UE trigger the GNSS measurement during C-DRX, UE needs to stop it after successful GNSS measurement in order to avoid that expiration of T390 may trigger another GNSS measurement.  However, even UE keeps T390 running when UE performs GNSS measurement during C-DRX with intention to keep consistent understanding with eNB on T390 status, it’s still possible that, when UE stops T390 upon finishing GNSS measurement, eNB still keep T390 running and later may trigger UE release when T390 expires. In order to avoid such case, the simple way is to require UE to also send GNSS report to the eNB after it finishes GNSS measurement during C-DRX.  <2> There is no HARQ RTT timer started for the case of HARQ feedback disabled. There is an ambiguity in the following note in section 5.7 that it is not possible to schedule UL and DL in parallel until HARQ RTT timer expires as for HARQ disabled case, there is never a scenario where HARQ RTT timer expires.  <3> The triggered GNSS validity duration reporting procedure is not cancelled when the MAC is reset. | | | | | | | | |
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| ***Summary of change:*** | | <1> Even for the GNSS measurement during C-DRX, UE is required to trigger remaining GNSS measurement validity duration report when it receives indication that a new GNSS position becomes valid.  <2> The note 4 in section 5.7 is clarified that it is only applicable for the case HARQ feedback is enabled.  <3> Cancel the triggered GNSS validity duration reporting procedure when MAC is rest.  **Impact analysis**  Impacted functionality:  GNSS operation and HARQ disabling function in IoT NTN  Inter-operability issues:  If the network is implemented according to this CR while the UE is not, there is no inter-operability issue.  If the UE is implemented according to this CR while the network is not, there is no inter-operability issue. | | | | | | | | |
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| ***Consequences if not approved:*** | | Unclear SPEC on GNSS enhancement and HARQ disabling. | | | | | | | | |
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| ***Clauses affected:*** | | 5.4.10, 5.7, 5.9 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R2-2406938 | | | | | | | | |

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| First Change |

### 5.4.10 GNSS validity duration reporting

For an NB-IoT UE, a BL UE or a UE in enhanced coverage in a non-terrestrial network, an indication may be sent by upper layers to report the remaining GNSS measurement validity duration.

If the MAC entity receives an indication from upper layers to report the remaining GNSS measurement validity duration:

- stop the *timeAlignmentTimer* associated with the pTAG, if running.

- initiate a Random Access procedure (see clause 5.1).

NOTE: When in RRC\_CONNECTED, if the UE autonomously starts and completes GNSS acquisition using available idle periods, the UE reports the remaining validity duration but it is up to UE implementation whether to stop *timeAlignmentTimer* and initiate a Random Access procedure.

If the GNSS validity duration reporting procedure has been triggered and not cancelled:

- if the MAC entity has UL resources allocated for new transmission for this TTI, and;

- if the allocated UL resources can accommodate the GNSS Validity Duration Report MAC control element plus its subheader, as a result of logical channel prioritization:

- instruct the Multiplexing and Assembly procedure to generate the GNSS Validity Duration Report MAC control element as defined in clause 6.1.3.23.

All triggered GNSS validity duration reports shall be cancelled when a GNSS Validity Duration Report MAC control element is included in a MAC PDU for transmission.

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| Second Change |

## 5.7 Discontinuous Reception (DRX)

The MAC entity may be configured by RRC with a DRX functionality that controls the UE's PDCCH monitoring activity for the MAC entity's C-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, Semi-Persistent Scheduling C-RNTI (if configured), UL Semi-Persistent Scheduling V-RNTI (if configured), eIMTA-RNTI (if configured), SL-RNTI (if configured), SL-V-RNTI (if configured), CC-RNTI (if configured), SRS-TPC-RNTI (if configured), and AUL C-RNTI (if configured). When in RRC\_CONNECTED, if DRX is configured, the MAC entity is allowed to monitor the PDCCH discontinuously using the DRX operation specified in this clause; otherwise the MAC entity monitors the PDCCH continuously. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other clauses of this specification. RRC controls DRX operation by configuring the timers *onDurationTimer*, *drx-InactivityTimer*, *drx-RetransmissionTimer* (for HARQ processes scheduled using 1ms TTI, one per DL HARQ process except for the broadcast process), *drx-RetransmissionTimerShortTTI* (for HARQ processes scheduled using short TTI, one per DL HARQ process), *drx-ULRetransmissionTimer* (for HARQ processes scheduled using 1ms TTI, one per asynchronous UL HARQ process), *drx-ULRetransmissionTimerShortTTI* (for HARQ processes scheduled using short TTI, one per asynchronous UL HARQ process), the *longDRX-Cycle*, the value of the *drxStartOffset* and optionally the *drxShortCycleTimer* and *shortDRX-Cycle*. A HARQ RTT timer per DL HARQ process (except for the broadcast process) and UL HARQ RTT Timer per asynchronous UL HARQ process is also defined (see clause 7.7). The HARQ mode per HARQ process can be configured in *uplinkHARQ-Mode*.

When a DRX cycle is configured, the Active Time includes the time while:

*- onDurationTimer* or *drx-InactivityTimer* or *drx-RetransmissionTimer* or *drx-RetransmissionTimerShortTTI* or *drx-ULRetransmissionTimer* or *drx-ULRetransmissionTimerShortTTI* or *mac-ContentionResolutionTimer* (as described in clause 5.1.5) is running; or

- a Scheduling Request is sent on PUCCH/SPUCCH and is pending (as described in clause 5.4.4). If this Serving Cell is part of a non-terrestrial network, the Active Time is started after the Scheduling Request transmission that is performed when the *SR\_COUNTER* is 0 for all the SR configurations with pending SR(s) plus the UE-eNB RTT; or

- an uplink grant for a pending HARQ retransmission can occur and there is data in the corresponding HARQ buffer for synchronous HARQ process; or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the preamble not selected by the MAC entity (as described in clause 5.1.4) ; or

- *mpdcch-UL-HARQ-ACK-FeedbackConfig* is configured and repetitions within a bundle are being transmitted according to UL\_REPETITION\_NUMBER. If this Serving Cell is part of a non-terrestrial network, the Active Time starts after the first repetition within the bundle plus the UE-eNB RTT when repetitions within the bundle are being transmitted.

When DRX is configured, the MAC entity shall for each subframe:

- if a HARQ RTT Timer expires in this subframe:

- if the data of the corresponding HARQ process was not successfully decoded:

- start the *drx-RetransmissionTimer* or *drx-RetransmissionTimerShortTTI* for the corresponding HARQ process;

*-* if NB-IoT:

- if lower layers had indicated multiple TBs were scheduled for the associated expired HARQ RTT Timer:

- start or restart *drx-InactivityTimer* when all HARQ RTT Timers have expired;

- else:

- start or restart the *drx-InactivityTimer*.

- if an UL HARQ RTT Timer expires in this subframe:

- start the *drx-ULRetransmissionTimer* or *drx-ULRetransmissionTimerShortTTI* for the corresponding HARQ process.

- if NB-IoT:

- if lower layers had indicated multiple TBs were scheduled for the associated expired HARQ RTT Timer:

- start or restart *drx-InactivityTimer* when all HARQ RTT Timers have expired;

- else:

- start or restart the *drx-InactivityTimer*.

- if a DRX Command MAC control element or a Long DRX Command MAC control element is received:

- stop *onDurationTimer*;

- stop *drx-InactivityTimer*.

- if *drx-InactivityTimer* expires or a DRX Command MAC control element is received in this subframe:

- if the Short DRX cycle is configured:

- start or restart *drxShortCycleTimer*;

- use the Short DRX Cycle.

- else:

- use the Long DRX cycle.

- if *drxShortCycleTimer* expires in this subframe:

- use the Long DRX cycle.

- if a Long DRX Command MAC control element is received:

- stop *drxShortCycleTimer*;

- use the Long DRX cycle.

- If the Short DRX Cycle is used and [(SFN \* 10) + subframe number] modulo (*shortDRX-Cycle*) = (*drxStartOffset*) modulo (*shortDRX-Cycle*); or

- if the Long DRX Cycle is used and [(SFN \* 10) + subframe number] modulo (*longDRX-Cycle*) = *drxStartOffset*:

- if NB-IoT:

- if there is at least one HARQ process for which neither HARQ RTT Timer nor UL HARQ RTT Timer is running, start *onDurationTimer*.

- else:

- start onDurationTimer.

- during the Active Time, for a PDCCH-subframe, if the subframe is not required for uplink transmission for half-duplex FDD UE operation, and if the subframe is not a half-duplex guard subframe, as specified in TS 36.211 [7], and if the subframe is not part of a configured measurement gap and if the subframe is not part of a configured Sidelink Discovery Gap for Reception, and for NB-IoT if the subframe is not required for uplink transmission or downlink reception other than on PDCCH; or

- during the Active Time, for a subframe other than a PDCCH-subframe and for a UE capable of simultaneous reception and transmission in the aggregated cells, if the subframe is a downlink subframe indicated by a valid eIMTA L1 signalling for at least one serving cell not configured with *schedulingCellId*, as specified in TS 36.331 [8] and if the subframe is not part of a configured measurement gap and if the subframe is not part of a configured Sidelink Discovery Gap for Reception; or

- during the Active Time, for a subframe other than a PDCCH-subframe and for a UE not capable of simultaneous reception and transmission in the aggregated cells, if the subframe is a downlink subframe indicated by a valid eIMTA L1 signalling for the SpCell and if the subframe is not part of a configured measurement gap and if the subframe is not part of a configured Sidelink Discovery Gap for Reception:

- monitor the PDCCH;

- if the PDCCH indicates a DL transmission or if a DL assignment has been configured for this subframe:

- if the UE is an NB-IoT UE, a BL UE or a UE in enhanced coverage:

- if the HARQ feedback is disabled by lower layers when *downlinkHARQ-FeedbackDisabledBitmap(-NB)* is not configured for the corresponding HARQ process; or

- if the HARQ feedback is disabled by *downlinkHARQ-FeedbackDisabledBitmap(-NB)* for the corresponding HARQ process, except for the HARQ feedback further reversed to enabled by lower layers when lower layers have indicated scheduling of transmission of multiple TBs; or

- if the HARQ feedback is enabled by downlinkHARQ-FeedbackDisabled*Bitmap(-NB)* for the corresponding HARQ process and further reversed to disabled by lower layers:

*-* if NB-IoT:

- if the UE is configured with a single DL and UL HARQ process:

- start or restart *drx-InactivityTimer* in the subframe containing the last repetition of the corresponding PDSCH reception + 12 subframes + deltaPDCCH, where deltaPDCCH is the interval starting from the subframe containing the last repetition of the corresponding PDSCH reception plus 12 subframes to the first subframe of the next PDCCH occasion.

- if lower layers have indicated scheduling of transmission of multiple TBs:

- start or restart *drx-InactivityTimer* in the subframe containing the last repetition of the PDSCH reception corresponding to the last scheduled TB + 12 subframes + deltaPDCCH, where deltaPDCCH is the interval starting from the subframe containing the last repetition PDSCH reception corresponding to the last scheduled TB plus 12 subframes to the first subframe of the next PDCCH occasion.

- else if the HARQ feedback is enabled for the corresponding HARQ process:

- if lower layers have indicated scheduling of transmission of multiple TBs:

- start the HARQ RTT Timers for all HARQ processes which the HARQ feedback are enabled corresponding to the scheduled TBs in the subframe containing the last repetition of the PDSCH corresponding to the last scheduled TB;

- else:

- start the HARQ RTT Timer for the corresponding HARQ process in the subframe containing the last repetition of the corresponding PDSCH reception;

- else:

- start the HARQ RTT Timer for the corresponding HARQ process;

- stop the *drx-RetransmissionTimer* or *drx-RetransmissionTimerShortTTI* for the corresponding HARQ process.

- if NB-IoT, stop *drx-ULRetransmissionTimer* for all UL HARQ processes.

- if the PDCCH indicates an UL transmission for an asynchronous HARQ process or if an UL grant has been configured for an asynchronous HARQ process for this subframe, or if the PDCCH indicates an UL transmission for an autonomous HARQ process or;

- if the uplink grant is a configured grant for the MAC entity's AUL C-RNTI and if the corresponding PUSCH transmission has been performed in this subframe:

- if *mpdcch-UL-HARQ-ACK-FeedbackConfig* is not configured; and

- if the corresponding HARQ process is not configured with HARQ mode B:

- if lower layers have indicated scheduling of transmission of multiple TBs:

- start the UL HARQ RTT Timers for all scheduled HARQ processes which are not configured with HARQ mode B in the subframe containing the last repetition of the PUSCH corresponding to the last scheduled TB;

- else:

- start the UL HARQ RTT Timer for the corresponding HARQ process in the subframe containing the last repetition of the corresponding PUSCH transmission;

- stop the *drx-ULRetransmissionTimer* or *drx-ULRetransmissionTimerShortTTI* for the corresponding HARQ process;

- if *mpdcch-UL-HARQ-ACK-FeedbackConfig* is configured and an UL HARQ-ACK feedback has not been received on PDCCH until the last repetition of the corresponding PUSCH transmission:

- if the corresponding HARQ process is not configured with HARQ mode B:

- start or restart the *drx-ULRetransmissionTimer* for the corresponding HARQ process in the subframe containing the last repetition of the corresponding PUSCH transmission;

*-* if NB-IoT:

- if the UE is configured with single UL and DL HARQ process and if the corresponding HARQ process is configured with HARQ mode B:

- start or restart *drx-InactivityTimer* in the subframe containing the last repetition of the corresponding PUSCH transmission + 1 subframe + deltaPDCCH, where deltaPDCCH is the interval starting from the subframe containing the last repetition of the corresponding PUSCH transmission plus 1 subframes to the first subframe of the next PDCCH occasion.

- if lower layers have indicated scheduling of transmission of multiple TBs and if a HARQ process is configured with HARQ mode B:

- start or restart *drx-InactivityTimer* in the subframe containing the last repetition of the PUSCH transmission corresponding to the last scheduled TB + 1 subframe + deltaPDCCH, where deltaPDCCH is the interval starting from the subframe containing the last repetition of the PUSCH transmission corresponding to the last scheduled TB plus 1 subframes to the first subframe of the next PDCCH occasion.

- if NB-IoT, stop *drx-RetransmissionTimer* for all DL HARQ processes.

- if the PDCCH indicates a new transmission (DL, UL or SL):

- if the UE is an NB-IoT UE:

- if the UE is configured with more than one HARQ process and PDCCH indicate the transmission is for a single TB:

- start or restart *drx-InactivityTimer*.

- else:

- start or restart *drx-InactivityTimer*.

- if the PDCCH indicates a transmission (DL, UL) for an NB-IoT UE:

- if the NB-IoT UE is configured with a single DL and UL HARQ process; or

- if the PDCCH indicates the transmission is for multiple TBs:

- stop *drx-Inactivity*Timer.

- stop *onDurationTimer.*

- if the PDCCH indicates an UL HARQ-ACK feedback for an asynchronous UL HARQ process for a UE configured with *mpdcch-UL-HARQ-ACK-FeedbackConfig*:

- if the lower layer had indicated scheduling of transmission of multiple TBs:

- stop *drx-ULRetransmissionTimer* for the corresponding UL HARQ process(es).

- else if the PUSCH transmission is completed:

- stop *drx-ULRetransmissionTimer* for all UL HARQ processes.

- if the PDCCH indicates HARQ feedback for one or more HARQ processes for which UL HARQ operation is autonomous:

- stop the *drx-ULRetransmissionTimer* for the corresponding HARQ process(es).

- in current subframe n, if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC control elements/Long DRX Command MAC control elements received and Scheduling Request sent until and including subframe n-5 when evaluating all DRX Active Time conditions as specified in this clause, type-0-triggered SRS, as specified in TS 36.213 [2], shall not be reported.

- if CQI masking (*cqi-Mask*) is setup by upper layers:

- in current TTI n, if *onDurationTimer* would not be running considering grants/assignments/DRX Command MAC control elements/Long DRX Command MAC control elements received until and including TTI n-5 when evaluating all DRX Active Time conditions as specified in this clause, CQI/PMI/RI/PTI/CRI on PUCCH shall not be reported.

- else:

- in current TTI n, if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC control elements/Long DRX Command MAC control elements received and Scheduling Request sent until and including TTI n-5 when evaluating all DRX Active Time conditions as specified in this clause, CQI/PMI/RI/PTI/CRI on PUCCH shall not be reported.

For NB-IoT, *onDurationTimer* may start within a PDCCH period and end within a PDCCH period. The UE shall monitor NPDCCH during these partial PDCCH periods while *onDurationTimer* is running.

Regardless of whether the MAC entity is monitoring PDCCH or not, the MAC entity receives and transmits HARQ feedback and transmits type-1-triggered SRS, as specified in TS 36.213 [2], when such is expected. The MAC entity monitors PDCCH addressed to CC-RNTI for a PUSCH trigger B, as specified in TS 36.213 [2], on the corresponding SCell even if the MAC entity is not in Active Time. when such is expected.

When the BL UE or the UE in enhanced coverage or NB-IoT UE receives PDCCH, the UE executes the corresponding action specified in this clause in the subframe following the subframe containing the last repetition of the PDCCH reception where such subframe is determined by the starting subframe and the DCI subframe repetition number field in the PDCCH specified in TS 36.213 [2], unless explicitly stated otherwise.

NOTE 1: The same Active Time applies to all activated serving cell(s).

NOTE 2: In case of downlink spatial multiplexing, if a TB is received while the HARQ RTT Timer is running and the previous transmission of the same TB was received at least N subframes before the current subframe (where N corresponds to the HARQ RTT Timer), the MAC entity should process it and restart the HARQ RTT Timer.

NOTE 3: The MAC entity does not consider PUSCH trigger B, as specified in TS 36.213 [2], to be an indication of a new transmission.

NOTE 4: For NB-IoT when HARQ RTT timer has been started for a HARQ process, for operation in FDD mode, and for operation in TDD mode with a single HARQ process, DL and UL transmissions will not be scheduled in parallel, i.e. if a DL transmission has been scheduled an UL transmission will not be scheduled until HARQ RTT Timer of the DL HARQ process has expired (and vice versa).

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| Third Change |

## 5.9 MAC Reset

If a reset of the MAC entity is requested by upper layers, the MAC entity shall:

- initialize Bj for each logical channel to zero;

- except for *pur-TimeAlignmentTimer,* if configured*,* stop (if running) all timers;

- except for *pur-TimeAlignmentTimer,* if configured*,* consider all *timeAlignmentTimer*sas expired and perform the corresponding actions in clause 5.2;

- set the NDIs for all uplink HARQ processes to the value 0;

- stop, if any, ongoing RACH procedure;

- discard explicitly signalled *ra-PreambleIndex* and *ra-PRACH-MaskIndex*, if any;

- flush Msg3 buffer;

- cancel, if any, triggered Scheduling Request procedure;

- cancel, if any, triggered Buffer Status Reporting procedure;

- cancel, if any, triggered Power Headroom Reporting procedure;

- cancel, if any, triggered Recommended bit rate query procedure;

- cancel, if any, triggered Timing Advance Reporting procedure;

- cancel, if any, triggered GNSS validity duration reporting procedure;

- flush the soft buffers for all DL HARQ processes;

- for each DL HARQ process, consider the next received transmission for a TB as the very first transmission;

- release, if any, Temporary C-RNTI;

- clear, if any, Differential Koffset.

If a partial reset of the MAC entity is requested by upper layers, for a serving cell, the MAC entity shall for the serving cell:

- set the NDIs for all uplink HARQ processes to the value 0;

- flush all UL HARQ buffers;

- stop all running *drx-ULRetransmissionTimers*;

- stop all running UL HARQ RTT timers;

- stop, if any, ongoing RACH procedure;

- discard explicitly signalled *ra-PreambleIndex* and *ra-PRACH-MaskIndex*, if any;

- flush Msg3 buffer;

- release, if any, Temporary C-RNTI.

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| End of change |