**3GPP TSG-RAN WG2 Meeting #109-bis-eDraft\_R2-2004044**

**20-30 April 2020, online**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **36.306** | **CR** | **1746** | **rev** | **1** | **Current version:** | **15.8.0** |  |
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| *For* [***HE******LP***](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:***  | Updates for Rel-16 additional enhancements NB-IoT |
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| ***Source to WG:*** | BlackBerry |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | NB-IOTenh3-Core  |  | ***Date:*** | 2020-04-21 |
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| ***Category:*** | C |  | ***Release:*** | Rel-16 |
|  | *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 canbe 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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | This CR captures the agreements for NB-IoT Rel-16 at RAN2-109-bis-e. |
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| ***Summary of change:*** | The following agreements have been captured in this CR:Scheduling Multiple DL/UL Transport Blocks (common with MTC):- For NB-IoT, support of multiTB-UL-r16 and multiTB-DL-r16 is conditional on support of two HARQ processes (NB-IoT only).- For LTE-M and NB-IoT, multiple TBs scheduling in multicast is optional without capability reporting.In addition, in the RRC NB-IoT CR, the following additional capabilties have been captured:*multiTB-DL-Interleaving, multiTB-UL-Interleaving*Defines whether the UE supports interleaved transmission when multiple TBs is scheduled in RRC\_CONNECTED for DL and UL respectively.If *multiTB-DL-Interleaving* or *multiTB-UL-Interleaving* is included, the UE shall also indicate support for *multiTB-DL* or *multiTB-UL* respectively*multiTB-HARQ-ACK-Bundling*Defines whether the UE supports HARQ ACK bundling for interleaved transmission for DL.If *multiTB-HARQ-ACK-Bundling* is included, the UE shall also indicate support for *multiTB-DL-Interleaving*.It is suggested to align for now TS 36.306 with the above. This can be revisited if necessary when the UE Features list is received from RAN1.Connection to 5GC (common with MTC):- RRC Connection re-establishment for the control plane for NB-IoT UEs connected to 5GC is optional, without capability reporting (NB-IoT only).(From RAN2-108).- The existing capability multipleDRB-r13 is also applicable to 5GC (NB-IoT only).- DL channel quality report can be supported for both NB-IoT and eMTC connected to 5GC. [No impact as CN type not mentioned means that in general the capability applies to both].- PUR is supported in EPC and 5GC.- Introduce separate UE capabilities pur-UP-5GC-r16 and pur-CP-5GC-r16.UE-group wake-up signal (WUS) (common with MTC):- Support of Release 16 WUS is independent to support of Release 15 WUS.Network management tool enhancement:- RACH report is not applicable to 5GC.- RLF report is not applicable to 5GC.- Support of RACH report is optional with capability reporting.- Support of RLF report is optional at the UE without capability reporting.Coexistence with NR:- Working assumption: Introduce two UE capabilities for handling resources reservation on DL or UL in PhyLayerParameters-NB-v16xy.- Working assumption: Two UE capabilities for handling resources reservation on DL or UL in PhyLayerParameters-NB-v16xy can be applied to both FDD and TDD, e.g., with separate values for FDD or TDD.- Working assumption: Two UE capabilities for handling resources reservation on DL or UL can be introduced into TS 36.306, e.g., section 4.3.4. |
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| ***Consequences if not approved:*** | WI cannot be completed. |
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| ***Clauses affected:*** | 3.3, 4, 4.3.4.182, 4.3.4.183, 4.3.4.a1 (new), 4.3.4.a2 (new), 4.3.4.a3 (new), 4.3.4.a4 (new), 4.3.4.a5 (new), 4.3.4.a6 (new), 4.3.8.5, 4.3.8.b1 (new), 4.3.8.b2 (new), 4.3.12.c (new), 6.7.6, 6.10.d (new), 6.16.e (new), 6.17.f (new), 6.18.g (new). |
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|  | **Y** | **N** |  |  |
| ***Other specs*** | **x** |  |  Other core specifications  | TS 36.331 CR xxxx  |
| ***affected:*** |  |  |  Test specifications |  |
| ***(show related CRs)*** |  |  |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
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| ***This CR's revision history:*** |  |

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| First change |

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

1xRTT CDMA2000 1x Radio Transmission Technology

ACK Acknowledgement

ACDC Application specific Congestion control for Data Communication

ANDSF Access Network Discovery and Selection Function

ANR Automatic Neighbour Relation

BCCH Broadcast Control Channel

CAS Cell Acquisition Subframes

CFI Control Format Indicator

CG Cell Group

CRS Cell-specific Rerefence Signal

CSG Closed Subscriber Group

CSI Channel State Information

DC Dual Connectivity

DCI Downlink Control Information

DL-SCH Downlink Shared Channel

E-UTRA Evolved Universal Terrestrial Radio Access

E-UTRAN Evolved Universal Terrestrial Radio Access Network

FDD Frequency Division Duplex

GERAN GSM/EDGE Radio Access Network

HARQ Hybrid Automatic Repeat Request

HRPD High Rate Packet Data

IRC Interference Rejection Combining

MAC Medium Access Control

MMSE Minimum Mean Squared Error

MO-EDT Mobile Originated Early Data Transmission

MRO Mobility Robustness Optimisation

MT-EDT Mobile Terminated Early Data Transmission

MTSI Multimedia Telephony Service for IMS

MUST MultiUser Superposition Transmission

NAICS Network Assisted Interference Cancellation/Suppression

NB-IoT Narrow Band Internet of Things

OS OFDM Symbol

PCell Primary Cell

PDCCH Physical Downlink Control Channel

PDCP Packet Data Convergence Protocol

PDSCH Physical Downlink Shared Channel

PHR Power Headroom Reporting

ProSe Proximity-based Services

PUCCH Physical Uplink Control Channel

PUR Preconfigured Uplink Resource

PUSCH Physical Uplink Shared Channel

QoE Quality of Experience

RACH Random Access CHannel

RAI Release Assistance Indication

RAT Radio Access Technology

RLC Radio Link Control

RLF Radio Link Failure

ROHC RObust Header Compression

RRC Radio Resource Control

SC-PTM Single Cell Point to Multipoint

SCC Secondary Component Carrier

SCell Secondary Cell

SI System Information

SL Sidelink

SL-DCH Sidelink Discovery CHannel

SL-SCH Sidelink Shared CHannel

SON Self Organizing Networks

SPT Short Processing Time

SR Scheduling Request

SSAC Service Specific Access Control

SSTD SFN and Subframe Timing Difference

STTI Short TTI

TDD Time Division Duplex

TTI Transmission Time Interval

UCI Uplink Control Information

UDC Uplink Data Compression

UE User Equipment

UL-SCH Uplink Shared Channel

UMTS Universal Mobile Telecommunications System

UTRA UMTS Terrestrial Radio Access

V2X Vehicle-to-Everything

WLAN Wireless Local Area Network

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| Next changes |

# 4 UE radio access capability parameters

The following clauses define the UE radio access capability parameters and minimum capabilities for MBMS capable UE. Only parameters for which there is the possibility for UEs to signal different values are considered as UE radio access capability parameters. Therefore, mandatory features without capability parameters that are the same for all UEs are not listed here. Also capabilities which are optional or conditionally mandatory for UEs to implement but do not have UE radio access capability parameter are listed in this specification.

E-UTRAN needs to respect the signalled UE radio access capability parameters when configuring the UE and when scheduling the UE.

All parameters shown in italics are signalled and correspond to a field defined in TS 36.331 [5].

For optional features, the UE radio access capability parameter indicates whether the feature has been implemented and successfully tested. For mandatory features with the UE radio access capability parameter, the parameter indicates whether the feature has been successfully tested.

The mandatory features required to be supported by a UE are the same for all UE categories unless explicitly specified elsewhere in the specifications.

Unless otherwise stated, the requirements on the maximum number of transport block bits are applicable for a TTI length of 1 ms. For other TTI lengths, the requirements shall be scaled according to clause 7.1.7 in TS 36.213 [22] in order to get the corresponding requirement.

The following UE radio access capability parameters specified in Chapter 4 are applicable in NB-IoT:

- *ue-Category-NB* in NB-IoT (clause 4.1C)

- *supportedROHC-Profiles-r13* (clause 4.3.1.1A)

- *maxNumberROHC-ContextSessions-r13* (clause 4.3.1.2A)

- *rlc-UM-r15 (*clause *4.3.2.5)*

- *multiTone-r13* (clause 4.3.4.55)

- *multiCarrier-r13* (clause 4.3.4.56)

- *twoHARQ-Processes-r14* (clause 4.3.4.62)

- *multiCarrier-NPRACH-r14* (clause 4.3.4.75)

- *multiCarrierPaging-r14* (clause 4.3.4.76)

- *interferenceRandomisation-r14* (clause 4.3.4.80)

- *wakeUpSignal-r15* (clause 4.3.4.113)

- *wakeUpSignalMinGap-eDRX-r15* (clause 4.3.4.114)

- *mixedOperationMode-r15* (clause 4.3.4.115)

- *sr-WithHARQ-ACK-r15* (clause 4.3.4.117)

- *sr-WithoutHARQ-ACK-r15* (clause 4.3.4.118)

- *nprach-Format2-r15* (clause 4.3.4.119)

- *multiCarrierPagingTDD-r15* (clause 4.3.4.134)

- *additionalTransmissionSIB1-r15* (clause 4.3.4.137)

- *npusch-3dot75kHz-SCS-TDD-r15* (clause 4.3.4.177)

- *multiTB-UL-r16* (clause 4.3.4.182)

- *multiTB-DL-r16* (clause 4.3.4.183)

- *multiTB-UL-Interleaving-r16* (clause 4.3.4.a1)

- *multiTB-DL-Interleaving-r16* (clause 4.3.4.a2)

- *multiTB-HARQ-ACK-Bundling-r16* (clause 4.3.4.a3)

- *groupWakeUpSignal-r16* (clause 4.3.4.a4)

- *ul-NR-ResourceReservation-r16* (clause 4.3.4.a5)

- *ul-NR-ResourceReservation-r16* (clause 4.3.4.a6)

- *supportedBandList-r13* (clause 4.3.5.1A)

- *multiNS-Pmax-r13* (clause 4.3.5.16A)

- *powerClassNB-20dBm-r13* (clause 4.3.5.1A.1)

- *powerClassNB-14dBm-r14* (clause 4.3.5.1A.2)

- *dl*-*ChannelQualityReporting-r16* (clause 4.3.6.37)

- *accessStratumRelease-r13* (clause 4.3.8.1A)

- *multipleDRB-r13* (clause 4.3.8.5)

- *earlyData-UP-r15* (clause 4.3.8.7)

- *earlySecurityReactivation-r16* (clause 4.3.8.11)

- *pur-CP-r16* (clause 4.3.8.12)

- *pur-UP-r16* (clause 4.3.8.13)

- *pur-CP-5GC-r16* (clause 4.3.8.b1)

- *pur-UP-5GC-r16* (clause 4.3.8.b2)

- *anr-Report-r16* (clause 4.3.12.2)

- *rach-Report-r16* (clause 4.3.12.c)

- *logicalChannelSR-ProhibitTimer* (clause 4.3.19.2)

- *dataInactMon-r14* (clause 4.3.19.9)

- *rai-Support-r14* (clause 4.3.19.10)

- *earlyContentionResolution-r14* (clause 4.3.19.14)

- *sr-SPS-BSR-r15* (clause 4.3.19.15)

- *rai-SupportEnh-r16* (clause 4.3.19.22)

- *earlyData-UP-5GC-r16* (clause 4.3.36.9)

The UE radio access capabilities specified in Chapter 4 are not applicable in NB-IoT, unless they are listed above.

The following optional features without UE radio access capability parameters specified in Chapter 6 are applicable in NB-IoT:

- RRC Connection Re-establishment for the Control Plane CIoT EPS Optimization (clause 6.7.5)

- System Information Block Type 16 (clause 6.8.1)

- Enhanced random access power control (clause 6.8.3)

- MT-EDT for Control Plane CIoT EPS Optimisation (clause 6.8.10)

- MT-EDT for User Plane CIoT EPS Optimisation (clause 6.8.11)

- EDT for Control Plane CIoT EPS Optimization (clause 6.8.4)

- Enhanced PHR (clause 6.8.6)

- Radio Link Failure Report for NB-IoT (clause 6.10.d)

- SC-PTM in Idle mode (clause 6.16.1)

- Multiple TB scheduling for multicast (clause 6.16.e)

- Relaxed monitoring (clause 6.17.1)

- DL channel quality reporting (clause 6.17.2)

- Serving cell idle mode measurements reporting (clause 6.17.3)

- NSSS-Based RRM measurements (clause 6.17.4)

- NPBCH-Based RRM measurements (clause 6.17.5)

- RRM measurements on non-anchor paging carriers (clause 6.17.6)

- DL channel quality reporting in MSG3 for non-anchor carrier (clause 6.17.f)

- User Plane CIoT 5GS optimisations (clause 6.18.1)

- RRC Connection Re-establishment for the Control Plane CIoT 5GS Optimisation (clause 6.18.g)

The optional features without UE radio access capability parameters specified in Chapter 6 are not applicable in NB-IoT, unless they are listed above.

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| Next changes |

#### 4.3.4.182 *multiTB-UL-r16*

This field indicates whether the UE supports multiple TB scheduling in the uplink as specified in TS 36.213 [22]. A UE indicating support of *multiTB-UL-r16* shall also indicate support of *twoHARQ-Processes-r14.* This feature is only applicable if the UE supports category NB2.

#### 4.3.4.183 *multiTB-DL-r16*

This field indicates whether the UE supports multiple TB scheduling in the downlink as specified in TS 36.213 [22]. A UE indicating support of *multiTB-DL-r16* shall also indicate support of *twoHARQ-Processes-r14.* This feature is only applicable if the UE supports category NB2.

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#### 4.3.4.a1 *multiTB-UL-Interleaving-r16*

This field indicates whether the UE supports interleaved transmissions when multiple TB scheduling is scheduled in the uplink as specified in TS 36.213 [22]. A UE indicating support of *multiTB-UL-Interleaving-r16* shall also indicate support of *multiTB-UL-r16.* This feature is only applicable if the UE supports category NB2.

#### 4.3.4.a2 *multiTB-DL-Interleaving-r16*

This field indicates whether the UE supports interleaved transmissions when multiple TB scheduling is scheduled in the downlink as specified in TS 36.213 [22]. A UE indicating support of *multiTB-DL-Interleaving-r16* shall also indicate support of *multiTB-DL-r16.* This feature is only applicable if the UE supports category NB2.

#### 4.3.4.a3 *multiTB-HARQ-ACK-Bundling-r16*

This field indicates whether the UE supports HARQ ACK bundling for interleaved transmission in the downlink as specified in TS 36.213 [22]. A UE indicating support of *multiTB-HARQ-ACK-Bundling-r16* shall also indicate support of *multiTB-DL-Interleaving-r16.* This feature is only applicable if the UE supports category NB2.

4.3.4.a4 *groupWakeUpSignal-r16*

This field indicates whether the UE supports Group WUS for FDD as specified in TS 36.211 [17], TS 36.213 [22] and TS 36.304 [14]. This feature is only applicable if the UE supports *ce-ModeA-r13* or if the UE supports any *ue-Category-NB*.

Editor’s note: FFS: Dependency on support of R15 WUS, currently RAN1 agreement and RAN2 working assumption are in conflict.

Editor’s note: For ce-ModeA-r13, FFS whether a separate capability is required for TDD or not.

4.3.4.a5 *ul-NR-ResourceReservation-r16*

This field defines whether the UE supports UL resource reservation for NB-IoT coexistence with NR, as specified in TS 36.211 [17]. This feature is only applicable if the UE supports any *ue-Category-NB*.

4.3.4.a6 *dl-NR-ResourceReservation-r16*

This field defines whether the UE supports DL resource reservation for NB-IoT coexistence with NR, as specified in TS 36.211 [17]. This feature is only applicable if the UE supports any *ue-Category-NB*.

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#### 4.3.8.5 *multipleDRB-r13*

This field defines whether the UE supports multiple DRBs. This field is only applicable if the UE supports S1-U data transfer or User plane CIoT EPS Optimisation as defined in TS[28] or NG-U data transfer or User plane CIoT 5GS Optimisation as defined in TS 24.501 [39], and any *ue-Category-NB*. If a UE of this release supports multiple DRBs, the UE shall support two simultaneous DRBs.

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4.3.8.b1 *pur-CP-5GC-r16*

This field indicates whether the UE supports Transmission using PUR for Control Plane CIoT 5GS optimisation as specified TS 36.300 [30]. This feature is only applicable if the UE supports *ce-ModeA-r13,* or for FDD if the UE supports any *ue-Category-NB*.

4.3.8.b2 *pur-UP-5GC-r16*

This field indicates whether the UE supports Transmission using PUR for User Plane 5GS EPS optimisation as specified TS 36.300 [30]. This feature is only applicable if the UE supports *ce-ModeA-r13,* or for FDD if the UE supports any *ue-Category-NB*.

Editor's note: In RRC the 4 PUR capabilities are part of MAC parameters for eMTC, but are part of general parameters for NB-IoT. Need to align one way or another.

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#### 4.3.12.c rach*-Report-r16*

This field defines whether the UE supports supports delivery of *rachReport* upon request from the network as specified in TS 36.331 [5], when connected to EPC. This feature is only applicable if the UE supports any *ue-Category-NB*.

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### 6.7.6 Void

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## 6.10 SON features

### 6.10.1 Radio Link Failure Report for inter-RAT MRO

It is optional for UE to include *previousUTRA-CellId* and *selectedUTRA-CellId* in *RLF-Report* upon request from the network as specified in TS 36.331 [5].

### 6.10.d Radio Link Failure Report for NB-IoT

It is optional for UE to support the storage of *RLF-Report* and the reporting in *UEInformationResponse* message when connected to EPC as specified in TS 36.331 [5]. This feature is only applicable if the UE supports any *ue-Category-NB*.

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| Next changes |

## 6.16 SC-PTM features

### 6.16.1 SC-PTM in Idle mode

It is optional for UE to support the SC-PTM reception in RRC\_IDLE as specified in TS 36.331 [5]. This feature is only applicable if the UE supports UE category M1 or UE category M2 or if the UE supports coverage enhancements (*ce-ModeB-r13* and/or *ce-ModeA-r13*) or for FDD, if the UE supports any *ue-Category-NB*.

6.16.e Multiple TB scheduling for SC-PTM in Idle mode

It is optional for UE to support multiple TB scheduling for multicast as specified in TS 36.331 [5]. This feature is only applicable if the UE supports *ce-ModeA-r13* or for FDD, if the UE supports any *ue-Category-NB*.

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| Next changes |

### 6.17.f DL channel quality reporting in MSG3 for non-anchor carrier

It is optional for UE to support DL channel quality reporting for a non-anchor carrier for FDD in MSG3, as defined in TS 36.331 [5]. This feature is only applicable if the UE supports any *ue-Category-NB.*

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## 6.18 E-UTRA/5GC features

### 6.18.1 User Plane CIoT 5GS optimisations

It is optional for UE to support User Plane CIoT 5GS optimisations for FDD, as defined in TS 24.501 [39]. This feature is only applicable if the UE supports any *ue-Category-NB* or if the UE supports *ce-ModeA-r13*.

### 6.18.2 Control Plane CIoT 5GS optimisations

It is optional for UE to support Control Plane CIoT 5GS optimisations for FDD, as defined in TS 24.501 [39]. This feature is only applicable if the UE supports *ce-ModeA-r13*.

### 6.18.g RRC Connection Re-establishment for the Control Plane CIoT 5GS Optimisation

It is optional for UE to support *RRCConnectionReestablishment* for the Control Plane CIoT 5GS Optimisation as specified in TS 36.331 [5]. This feature is only applicable if the UE supports any *ue-Category-NB*.