**3GPP TSG-RAN2 Meeting #116bis-e *R2-220xxxx***

**Online, 17 – 25 Jan 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.306** | **CR** | **-** | **rev** | **-** | **Current version:** | **16.6.0** |  |
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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:*** | Running CR: Introduction of additional enhancements for NB-IoT and eMTC | | | | | | | | | |
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| ***Source to WG:*** | ZTE Corporation, Sanechips | | | | | | | | | |
| ***Source to TSG:*** | RAN2 | | | | | | | | | |
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| ***Work item code:*** | NB\_IOTenh4\_LTE\_eMTC6 | | | | |  | ***Date:*** | | | 2022-01-28 |
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| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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)* | |
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| ***Reason for change:*** | | Introduction of additional enhancements for NB-IoT and eMTC in Rel-17 | | | | | | | | |
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| ***Summary of change:*** | | The following capabilities and agreements have been captured in this CR:  **NB-IoT neighbour cell measurements and corresponding measurement triggering before RLF**  RAN2#115-e:   * Support for connected mode measurement is optional with capability signalling.   RAN2#116bis-e:   * FFS whether support for connected mode measurements for RLF is indicated with or without FDD/TDD differentiation. * Support for connected mode measurements for RLF is indicated without EPC/5GC differentiation.   **NB-IoT carrier selection based on the coverage level, and associated carrier specific configuration**  RAN2#115-e:   * UE capability for Rel-17 paging carrier selection should be introduced   RAN2#116bis-e:   * Support for coverage based paging carrier selection is indicated without FDD/TDD differentiation. * Support for coverage based paging carrier selection is indicated without EPC/5GC differentiation.   **NB-IoT 16-QAM for unicast in UL and DL**  RAN1#103-e:   * At least for standalone and guard-band deployments, the maximum TBS to support 16-QAM for unicast in DL is 4968 bits with ISF=7.   RAN1#104-e:   * The soft buffer size for Cat. NB2 UEs supporting 16QAM for downlink is 12800 bits.   RAN2#113-e:   * Working assumption: For the UE supporting 16-QAM, the L2 buffer size is 12000 bytes.   RAN2#115-e:   * Confirm the working assumption: The support of 16-QAM uses separate UE capabilities for DL and UL.   RAN2#116-e:   * Confirm the working assumption of 12000 bytes for DL 16QAM for NB-IoT.   RAN2#116bis-e:   * For 16-QAM for unicast NPDSCH and 16-QAM for unicast NPUSCH, wait for RAN1 to conclude on the scope of the capability before discussion FDD/TDD differentiation. * Support for 16-QAM for unicast NPDSCH & 16-QAM for unicast NPUSCH are indicated without EPC/5GC differentiation.   **LTE-MTC 14 HARQ processes in DL for HD-FDD Cat M1 UEs**  RAN1#107-e:   * For component 3 in FG 1-3, UE reports one of {Alt-1, Alt-1 and Alt-2e}   + Alt-1: The HARQ-ACK delay is determined through an expression consisting of different subframe types (Using a similar principle as the PDSCH scheduling delay).   + Alt-2e: The HARQ-ACK delay is determined following the legacy approach. That is, the “HARQ-ACK delay” is kept expressed in terms of “absolute subframes”.   RAN2#113bis-e:   * Working assumption: No change to current L2 buffer size requirement.   RAN2#115-e:   * Confirm the working assumption: No change to current L2 buffer size requirement for HD-FDD Cat M1 UEs supporting 14 HARQ processes in DL.   RAN2#116bis-e:   * Introduce a new UE capability ce-14HARQProcesses-r17, conditional to support of ce-ModeA-r13. Signalling of the capability implies support of HARQ-ACK delay solution with Alt-1. * Introduce a new UE capability ce-14HARQProcesses-Alt2-r17, conditional to support of ce-14HARQProcesses-r17, for additional support of HARQ-ACK delay solution with Alt-2e. * Support for 14 HARQ processes for PDSCH is indicated without EPC/5GC differentiation.   **LTE-MTC Max DL TBS of 1736 bits for HD-FDD Cat. M1 UEs in CE mode A only**  RAN2#115-e:   * The table 4.1A-1 in TS 36.306 for DL Category M1 needs to be updated to indicate 1736 bits TBS and 43008 soft channel bits.   RAN2#116-e:   * No change to existing L2 buffer requirements for supporting 1736bits TBS for eMTC.   RAN2#116bis-e:   * Support for maximum DL TBS of 1736 bits is indicated without EPC/5GC differentiation.   **Power reduction for PRACH, PUCCH, and full-PRB PUSCH**  RAN2#116bis-e:   * Wait for RAN4 to decide which capability is needed for power reduction for PRACH, PUCCH, and full-PRB PUSCH. | | | | | | | | |
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| ***Consequences if not approved:*** | | Rel-17 enhancements for NB-IoT and eMTC are not supported. | | | | | | | | |
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| ***Clauses affected:*** | | 4, 4.1A, 4.1C, 4.3.4, 4.3.6, 4.3.8 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS/TR 36.331 CR xxxx | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R2-2200029 – Initial version | | | | | | | | |

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| FIRST CHANGE |

# 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 or 11.1 in TS 36.213 [22] in order to get the corresponding requirement.

The following UE radio access capability parameters specified in clause 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)

- *npusch-MultiTB-r16* (clause 4.3.4.182)

- *npdsch-MultiTB-r16* (clause 4.3.4.183)

- *npusch-MultiTB-Interleaving-r16* (clause 4.3.4.192)

- *npdsch-MultiTB-Interleaving-r16* (clause 4.3.4.193)

- *multiTB-HARQ-AckBundling-r16* (clause 4.3.4.194)

- *groupWakeUpSignal-r16* (clause 4.3.4.195)

- *groupWakeUpSignalAlternation-r16* (clause 4.3.4.196)

- *subframeResourceResvUL-r16* (clause 4.3.4.197)

- *subframeResourceResvDL-r16* (clause 4.3.4.198)

- *slotSymbolResourceResvUL-r16* (clause 4.3.4.199)

- *slotSymbolResourceResvDL-r16* (clause 4.3.4.200)

- *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)

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

- *rach-Report-r16* (clause 4.3.12.3)

- *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)

- *pur-CP-EPC-r16* (clause 4.3.37.1)

- *pur-UP-EPC-r16* (clause 4.3.37.2)

- *pur-CP-5GC-r16* (clause 4.3.37.3)

- *pur-UP-5GC-r16* (clause 4.3.37.4)

- *pur-CP-L1Ack-r16* (clause 4.3.37.5)

- *pur-NRSRP-Validation-r16* (clause 4.3.37.6)

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

Editor’s Note: The new-added NB-IoT UE capabilities would be added to the above list.

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 6.10.2)

- SC-PTM in Idle mode (clause 6.16.1)

- Multiple TB scheduling for SC-PTM in Idle mode for NB-IoT (clause 6.16.2)

- Relaxed monitoring (clause 6.17.1)

- DL channel quality reporting in Msg3 for the anchor carrier (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)

- NRS presence on non-anchor paging carriers (clause 6.17.7)

- DL channel quality reporting in Msg3 for non-anchor carrier (clause 6.17.8)

- Assistance information for inter-RAT cell selection to/from NB-IoT (clause 6.17.9)

- RRC Connection Re-establishment for the Control Plane CIoT 5GS Optimisation (clause 6.18.3)

- NB-IoT/5GC (clause 6.18.4)

- MO-EDT for Control Plane CIoT 5GS Optimisation (clause 6.18.5)

- AS RAI (clause 6.18.6)

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

Editor’s Note: The new-added optional features without UE radio access capability (if has) would be added to the above list.

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| NEXT CHANGE |

## 4.1A *ue-CategoryDL* and *ue-CategoryUL*

The fields *ue-CategoryDL* and *ue-CategoryUL* define downlink/uplink capability respectively. The parameters set by the UE DL/UL Categories are defined in clause 4.2. Tables 4.1A-1 and 4.1A-2 define the downlink and, respectively, uplink physical layer parameter values for each UE DL/UL Category.Table 4.1A-4 defines the minimum capability for the maximum number of bits of a MCH transport block received within a TTI for an MBMS capable UE capable of reception via MBSFN. Table 4.1A-6 defines the only combinations for UE UL and DL Categories that are allowed to be signalled with *ue-CategoryDL* and *ue-CategoryUL*. Table 4.1A-6 also defines which UE Categories a UE shall indicate in addition to the combinations for UE UL and DL Categories. For a BL UE, Table 4.1A-7 defines the only combinations for UE UL and DL Categories that are allowed to be signalled with *ue-CategoryDL* and *ue-CategoryUL*, and which UE Categories a UE shall indicate in addition to the combinations for UE UL and DL Categories. A UE indicating DL category 13 may indicate category 9 or 10 in *ue-Category-v1170*. A UE indicating Category M2 shall also indicate Category M1.

Table 4.1A-1: Downlink physical layer parameter values set by the field *ue-CategoryDL*

|  |  |  |  |  |
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| UE DL Category | Maximum number of DL-SCH transport block bits received within a TTI (Note 1) | Maximum number of bits of a DL-SCH transport block received within a TTI | Total number of soft channel bits | Maximum number of supported layers for spatial multiplexing in DL |
| DL Category M1  (Note 4) | 1000 or 1736 | 1000 or 1736 | 25344 or 43008 | 1 |
| DL Category M2 | 4008 | 4008 | 73152 | 1 |
| DL Category 0 (Note 2) | 1000 | 1000 | 25344 | 1 |
| DL Category 1bis | 10296 | 10296 | 250368 | 1 |
| DL Category 4 | 150752 | 75376 | 1827072 | 2 |
| DL Category 6 | 301504 | 149776 (4 layers, 64QAM)  75376 (2 layers, 64QAM) | 3654144 | 2 or 4 |
| DL Category 7 | 301504 | 149776 (4 layers, 64QAM)  75376 (2 layers, 64QAM) | 3654144 | 2 or 4 |
| DL Category 9 | 452256 | 149776 (4 layers, 64QAM)  75376 (2 layers, 64QAM) | 5481216 | 2 or 4 |
| DL Category 10 | 452256 | 149776 (4 layers, 64QAM)  75376 (2 layers, 64QAM) | 5481216 | 2 or 4 |
| DL Category 11 | 603008 | 149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM) | 7308288 | 2 or 4 |
| DL Category 12 | 603008 | 149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM) | 7308288 | 2 or 4 |
| DL Category 13 | 391632 | 195816 (4 layers, 256QAM)  97896 (2 layers, 256QAM) | 3654144 | 2 or 4 |
| DL Category 14 | 3916560 | 391656 (8 layers, 256QAM) | 47431680 | 8 |
| DL Category 15 | 749856-807744 (Note 3) | 149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported) | 9744384 | 2 or 4 |
| DL Category 16 | 978960 -1051360 (Note 3) | 149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported) | 12789504 | 2 or 4 |
| DL Category 17 | 25065984 | 391656 (8 layers, 256QAM) | 303562752 | 8 |
| DL Category 18 | 1174752-1211616 (Note 3) | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported) | 14616576 | 2 or 4 or 8 |
| DL Category 19 | 1566336 -1658272 (Note 3) | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported) | 19488768 | 2 or 4 or 8 |
| DL Category 20 | 1948064 - 2019360 (Note 3) | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM),  502624 (8 layers, 1024QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  251640 (4 layers, 1024QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  125808 (2 layers, 1024QAM) | 24360960 | 2 or 4 or 8 |
| DL Category 21 | 1348960 - 1413120 (Note 3) | 149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported) | 17052672 | 2 or 4 |
| DL Category 22 | 2349504 – 2562784 | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM)  502624 (8 layers, 1024QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  251640 (4 layers, 1024QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  125808 (2 layers, 1024QAM) | 29233152 | 2 or 4 or 8 |
| DL Category 23 | 2695968 – 2869920 | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM)  502624 (8 layers, 1024QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  251640 (4 layers, 1024QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  125808 (2 layers, 1024QAM) | 34105344 | 2 or 4 or 8 |
| DL Category 24 | 2936880 – 3028608 | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM)  502624 (8 layers, 1024QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  251640 (4 layers, 1024QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  125808 (2 layers, 1024QAM) | 36541440 | 2 or 4 or 8 |
| DL Category 25 | 3132672 – 3316544 | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM)  502624 (8 layers, 1024QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  251640 (4 layers, 1024QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  125808 (2 layers, 1024QAM) | 38977536 | 2 or 4 or 8 |
| DL Category 26 | 3422400– 3531888 | 299856 (8 layers, 64QAM)  391656 (8 layers, 256QAM)  502624 (8 layers, 1024QAM)  149776 (4 layers, 64QAM)  195816 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  201936 (4 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  251640 (4 layers, 1024QAM)  75376 (2 layers, 64QAM)  97896 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is not supported)  100752 (2 layers, 256QAM, if *alternativeTBS-Index-r14* is supported)  125808 (2 layers, 1024QAM) | 42631680 | 2 or 4 or 8 |
| NOTE 1: In carrier aggregation operation, the DL-SCH processing capability can be shared by the UE with that of MCH received from a serving cell. If the total eNB scheduling for DL-SCH and an MCH in one serving cell at a given TTI is larger than the defined processing capability, the prioritization between DL-SCH and MCH is left up to UE implementation.  NOTE 2: Within one TTI, a UE indicating category 0 shall be able to receive up to 1000 bits for a transport block associated with C-RNTI/Semi-Persistent Scheduling C-RNTI/P-RNTI/SI-RNTI/RA-RNTI and up to 2216 bits for another transport block associated with P-RNTI/SI-RNTI/RA-RNTI.  NOTE 3: The UE indicating category x shall reach the value within the defined range indicated by "Maximum number of DL-SCH transport block bits received within a TTI" of category x. The UE shall determine the required value within the defined range indicated by "Maximum number of DL-SCH transport block bits received within a TTI" of the corresponding category, based on its capabilities (i.e. CA band combination, MIMO, Modulation scheme). If the UE capability of CA band combination, MIMO and modulation scheme supported can exceed the upper limit of the defined range, the UE shall support the maximum value of the defined range indicated by "Maximum number of DL-SCH transport block bits received within a TTI" of the corresponding category.  NOTE 4: The UE supports "Maximum number of DL-SCH transport block bits received within a TTI" and "Maximum number of bits of a DL-SCH transport block received within a TTI" of 1736 bits and "Total number of soft channel bits" of 43008 bits if the UE indicates support of *ce-PDSCH-NB-MaxTBS-r17*. Otherwise the UE supports "Maximum number of DL-SCH transport block bits received within a TTI" and "Maximum number of bits of a DL-SCH transport block received within a TTI" of 1000 bits and "Total number of soft channel bits" of 25344 bits. | | | | |

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| NEXT CHANGE |

## 4.1C *ue-Category-NB*

The field *ue-Category-NB* defines a combined uplink and downlink capability in NB-IoT. The parameters set by the UE Category are defined in clause 4.2. Tables 4.1C-1 and 4.1C-2 define the downlink and, respectively, uplink physical layer parameter values for each UE Category. A UE indicating Category NB2 shall also indicate Category NB1.

Table 4.1C-1: Downlink physical layer parameter values set by the field *ue-Category-NB*

|  |  |  |  |
| --- | --- | --- | --- |
| UE Category | Maximum number of DL-SCH transport block bits received within a TTI | Maximum number of bits of a DL-SCH transport block received within a TTI | Total number of soft channel bits |
| Category NB1 | 680 | 680 | 2112 |
| Category NB2  (Note 1) | 2536 or 4968 | 2536 or 4968 | 6400 or 12800 |
| NOTE 1: The UE supports " Maximum number of DL-SCH transport block bits received within a TTI" and " Maximum number of bits of a DL-SCH transport block received within a TTI" of 4968 bits and "Total number of soft channel bits" of 12800 bits if the UE indicates support of *npdsch-16QAM-r17*. Otherwise the UE supports " Maximum number of DL-SCH transport block bits received within a TTI" and " Maximum number of bits of a DL-SCH transport block received within a TTI" of 2536 bits and "Total number of soft channel bits" of 6400 bits. | | | |

Table 4.1C-2: Uplink physical layer parameter values set by the field *ue-Category-NB*

|  |  |  |
| --- | --- | --- |
| UE Category | Maximum number of UL-SCH transport block bits transmitted within a TTI | Maximum number of bits of an UL-SCH transport block transmitted within a TTI |
| Category NB1 | 1000 | 1000 |
| Category NB2 | 2536 | 2536 |

Table 4.1C-3: Total layer 2 buffer sizes set by the field *ue-Category-NB*

|  |  |
| --- | --- |
| UE Category | Total layer 2 buffer size [bytes] |
| Category NB1 | 4000 |
| Category NB2  (Note 1) | 8000 or 12000 |
| NOTE 1: The UE supports "Total layer 2 buffer size" of 12000 bytes if the UE indicates support of *npdsch-16QAM-r17*. Otherwise the UE supports 8000 bytes. | |

Table 4.1C-5: Half-duplex FDD operation type set by the field *ue-Category-NB* for a half-duplex FDD capable UE

|  |  |
| --- | --- |
| UE Category | Half-duplex FDD operation type |
| Category NB1 | Type B |
| Category NB2 | Type B |

|  |
| --- |
| NEXT CHANGE |

### 4.3.4 Physical layer parameters

//skip the unrelated part//

#### 4.3.4.221 *addSRS-r16*

Presence of this field indicates the UE supports the additional SRS symbol(s) within the normal UL subframes in TDD as described in TS 36.213 [23].

##### 4.3.4.221.1 *addSRS-1T2R-r16*

Indicates whether the UE supports selecting one antenna among two antennas to transmit additional SRS symbol(s) for the corresponding band of the band combination as described in TS 36.213 [23]. This field can be included only if *addSRS-r16* is included.

##### 4.3.4.221.2 *addSRS-1T4R-r16*

Indicates whether the UE supports selecting one antenna among four antennas to transmit additional SRS symbol(s) for the corresponding band of the band combination as described in TS 36.213 [23]. This field can be included only if *addSRS-r16* is included.

##### 4.3.4.221.3 *addSRS-2T4R-2Pairs-r16*

Indicates whether the UE supports selecting one antenna pair between two antenna pairs to transmit additional SRS symbol(s) simultaneously for the corresponding band of the band combination as described in TS 36.213 [23]. This field can be included only if *addSRS-r16* is included.

##### 4.3.4.221.4 *addSRS-2T4R-3Pairs-r16*

Indicates whether the UE supports selecting one antenna pair among three antenna pairs to transmit additional SRS symbol(s) simultaneously for the corresponding band of the band combination as described in TS 36.213 [23]. This field can be included only if *addSRS-r16* is included.

##### 4.3.4.221.5 *addSRS-AntennaSwitching-r16*

Indicates the antenna switching capabilities for additional SRS symbol(s). This field can be included only if *addSRS-r16* is included.

#### 4.3.4.xxa *npusch-16QAM-r17*

This field indicates whether the UE supports 16QAM for UL unicast, as specified in TS 36.211 [17], TS 36.212 [26] and TS 36.213 [22]. This feature is only applicable if the UE supports category NB2.

#### 4.3.4.xxb *npdsch-16QAM-r17*

This field indicates whether the UE supports 16QAM for DL unicast, as specified in TS 36.211 [17], TS 36.212 [26] and TS 36.213 [22]. This feature is only applicable if the UE supports category NB2.

Editor’s Note: For 16QAM, wait for RAN1 to conclude on the scope of the capability before discussion FDD/TDD differentiation.

#### 4.3.4.xxc *ce-PDSCH-NB-MaxTBS-r17*

This field indicates whether the UE supports the maximum DL TBS size of 1736 bits in 1.4 MHz when operating in coverage enhancement mode A as specified in TS 36.213 [22]. A UE indicating support of *ce-PDSCH-NB-MaxTBS-r17* shall also indicate support of *ce-ModeA-r13*.

#### 4.3.4.xxd *ce-PDSCH-14HARQProcesses-r17*

This field indicates whether the UE supports 14 DL HARQ processes in FDD when operating in coverage enhancement mode A, as specified in TS 36.212 [26] and TS 36.213 [22]. A UE indicating support of *ce-PDSCH-14HARQProcesses-r17* shall also indicate support of *ce-ModeA-r13*. Support of *ce-PDSCH-14HARQProcesses-r17* implicitly means support of HARQ-ACK delay solution with Alt-1, as specified in TS 36.213 [22].

#### 4.3.4.xxe *ce-PDSCH-14HARQProcesses-Alt2-r17*

This field indicates whether the UE supports 14 DL HARQ processes in FDD when operating in coverage enhancement mode A, as specified in TS 36.212 [26] and TS 36.213 [22]. A UE indicating support of *ce-PDSCH-14HARQProcesses-Alt2-r17* shall also indicate support of *ce-PDSCH-14HARQProcesses-r17.* Support of *ce-PDSCH-14HARQProcesses-Alt2-r17* implicitly means additional support of HARQ-ACK delay solution with Alt-2e, as specified in TS 36.213 [22].

|  |
| --- |
| NEXT CHANGE |

### 4.3.6 Measurement parameters

//skip the unrelated part//

4.3.6.47 *nr-IdleInactiveBeamMeasFR2-r16*

This field defines whether the UE supports performing eNB-configured SSB-based beam level RRM measurements for configured NR FR2 carrier(s) in RRC\_IDLE and in RRC\_INACTIVE (if the UE also indicates support of *inactiveState-r15*), including reporting them when requested by the eNB while resuming from RRC\_IDLE/RRC\_INACTIVE or in RRC\_CONNECTED, as specified in TS 36.331 [5].

A UE that supports this feature shall also support *nr-IdleInactiveMeasFR2-r16*.

#### 4.3.6.xa *connectedModeMeasurements-r17*

This field indicates whether the UE in RRC\_CONNECTED supports neighbour cell measurements, as specified in TS 36.133 [16] and TS 36.331 [5]. This field is only applicable for UEs of any *ue-Category-NB*.

Editor’s Note: FFS whether support for connected mode measurements for RLF is indicated with or without FDD/TDD differentiation.

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| --- |
| NEXT CHANGE |

### 4.3.8 General parameters

//skip the unrelated part//

#### 4.3.8.15 *altFreqPriority-r16*

This field defines whether the UE supports alternative cell reselection priority as defined in TS 36.331 [5].

#### 4.3.8.xa *coverageBasedPaging-r17*

This field indicates whether the UE in RRC\_IDLE supports coverage based paging carrier selection as specified in TS 36.304 [14]. A UE indicating support of *coverageBasedPaging-r17* shall also indicate *multiCarrierPaging-r14* or *multiCarrierPagingTDD-r15*. This field is only applicableif the UE supports any *ue-Category-NB*.

Editor’s Note: Wait for RAN4 to decide which capability is needed for power reduction for PRACH, PUCCH, and full-PRB PUSCH.