**3GPP TSG-RAN WG2 Meeting #117-e *R2-2203580***

**Online, 21 February – 3 March 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.302** | **CR** | **1211** | **rev** | **1** | **Current version:** | **16.1.0** |  |
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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:*** | Introduction of Rel-17 enhancements for NB-IoT and eMTC | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NB\_IOTenh4\_LTE\_eMTC6-Core | | | | |  | ***Date:*** | | | 2022-03-10 |
|  |  | | | |  | |  | | |  |
| ***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 Rel-17 enhancements for NB-IoT and eMTC | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce support of 16QAM UL and DL in NB-IoT | | | | | | | | |
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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:*** | | 6.1.1, 6.2.1 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 36.300 CR 1354  TS 36.331 CR 4760  TS 36.321 CR 1536  TS 36.306 CR 1841  TS 36.304 CR 0844 | | |
| ***affected:*** | |  |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R2-2203217: Initial vesrion submitted at RAN2#117-e | | | | | | | | |

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| Beginning of change |

### 6.1.1 Uplink Shared Channel

The physical-layer model for Uplink Shared Channel transmission is described based on the corresponding physical-layer-processing chain, see Figure 6.1.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue. It should be noted that, in the cases of PUSCH and NPUSCH, the scheduling decision is fully done at the network side. The uplink transmission control in the UE then configures the uplink physical-layer processing, based on uplink transport-format and resource-assignment information received on the downlink.

**- Higher-layer data passed to/from the physical layer**

- One transport block of dynamic size delivered to the physical layer once every TTI.

**- CRC and transport-block-error indication**

- Transport-block-error indication delivered to higher layers.

**- FEC and rate matching**

- Channel coding rate is implicitly given by the combination of transport block size, modulation scheme and resource assignment;

- Physical layer model support of HARQ: in case of Incremental Redundancy, the corresponding Layer 2 Hybrid-ARQ process controls what redundancy version is to be used for the physical layer transmission for each TTI.

**- Interleaving**

- No control of interleaving by higher layers.

**- Data modulation**

- Modulation scheme is decided by MAC Scheduler (QPSK, 16QAM, 64QAM, and 256QAM; for BL UEs or UEs in enhanced coverage, supported modulation schemes are QPSK and 16QAM; for NB-IoT, supported modulation schemes are Pi/4-QPSK and Pi/2-BPSK for single-tone allocation, QPSK and 16QAM for multi-tone allocation).

**- Mapping to physical resource**

- L2-controlled resource assignment.

**- Multi-antenna processing**

- MAC Scheduler partly configures mapping from assigned resource blocks to the available number of antenna ports.

**- Support of L1 control signalling**

- Transmission of ACK/NACK and CSI feedback related to DL data transmission

The model of Figure 6.1.1-1 also captures

- Transport via physical layer of Hybrid-ARQ related information associated with the PUSCH, to the peer HARQ process at the transmitter side;

- Transport via physical layer of corresponding HARQ acknowledgements to PUSCH transmitter side (except for NB-IoT UEs).

If a UE is configured with one or more SCells, the physical-layer-processing chain in Figure 6.1.1-1 is repeated for every UL Serving Cell.



Figure 6.1.1-1: Physical-layer model for UL-SCH transmission

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| Next change |

### 6.2.1 Downlink-Shared Channel

The physical-layer model for Downlink Shared Channel transmission is described based on the corresponding PDSCH or NPDSCH physical-layer-processing chain, see Figure 6.2.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue on the figure.

**- Higher-layer data passed to/from the physical layer**

- N (up to two) transport blocks of dynamic size delivered to the physical layer once every TTI.

**- CRC and transport-block-error indication**

- Transport-block-error indication delivered to higher layers.

**- FEC and rate matching**

- Channel coding rate is implicitly given by the combination of transport block size, modulation scheme and resource assignment;

- Physical layer model support of HARQ: in case of Incremental Redundancy, the corresponding Layer 2 Hybrid-ARQ process controls what redundancy version is to be used for the physical layer transmission for each TTI.

**- Data modulation**

- Modulation scheme is decided by MAC Scheduler (QPSK, 16QAM, 64 QAM, 256QAM, and 1024QAM; for BL UEs or UEs in enhanced coverage, supported modulation schemes are QPSK and 16QAM, and 64QAM for CE mode A with no repetitions; for NB-IoT, QPSK and 16QAM are supported).

**Multi-antenna processing**

- MAC Scheduler partly configures mapping from modulated code words (for each stream) to the available number of antenna ports.

**- Mapping to physical resource**

- L2-controlled resource assignment.

**- Support of L1 control signalling**

- Transmission of scheduler related control signals.

**- Support for Hybrid-ARQ-related signalling**

The model of Figure 6.2.1-1 also captures:

- Transport via physical layer of Hybrid-ARQ related information associated with the PDSCH, to the peer HARQ process at the receiver side;

- Transport via physical layer of corresponding HARQ acknowledgements to PDSCH transmitter side.

If a UE is configured with one or more SCells, the physical-layer-processing chain in Figure 6.2.1-1 is repeated for every DL Serving Cell.

NOTE: The signalling of transport-format and resource-allocation is not captured in the physical-layer model. At the transmitter side, this information can be directly derived from the configuration of the physical layer. The physical layer then transports this information over the radio interface to its peer physical layer, presumably multiplexed in one way or another with the HARQ-related information. On the receiver side, this information is, in contrast to the HARQ-related information, used directly within the physical layer for PDSCH demodulation, decoding etc., without passing through higher layers.



Figure 6.2.1-1: Physical-layer model for DL-SCH transmission