**3GPP TSG-RAN WG4 Meeting #96-e *R4-2012600***

**Electronic Meeting, 17- 28 Aug, 2020**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.104** | **CR** | **4909** | **rev** | **1** | **Current version:** | **16.6.0** |  |
|  | | | | | | | | |
| *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 |  | Radio Access Network | **x** | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Introduce NPUSCH format 1 performance requirements for multi-TB interleaved transmission. | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NB\_IOTenh3-Perf | | | | |  | ***Date:*** | | | 2020-08-04 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***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 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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | RAN 4 has agreed to introduce the performance requirements for NPUSCH format 1with multi-TB interleaved transmission and WF R4-2008759 has been approved. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Add the performance requirments for NPUSCH format 1 with multi-TB interleaved transmission to clause 8.5.1.1.1. 2. Add the new FRC for NPUSCH format 1 related to this feature to clause   A.16.1 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The performance requirements will still be incompleted. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.5.1.1.1, A.16.1. | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 36.141 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*<Start of change>*

### 8.5.1 Requirements for NPUSCH format 1

#### 8.5.1.1 Requirements

The performance requirement of NPUSCH format 1 is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in Annex A16. The performance requirements assume HARQ retransmissions.

An NB-IoT Base Station supports 15 kHz subcarrier spacing requirements, or 3.75 kHz subcarrier spacing requirements, or both.

For 15kHz subcarrier spacing single-subcarrier/multi-subcarrier, the demodulation requirements apply for the supported number of subcarriers.Table 8.5.1.1-1: Test parameters

|  |  |
| --- | --- |
| Parameter | Value |
| Maximum number of HARQ transmissions | 4 |
| RV sequence | RV0, RV2 |

##### 8.5.1.1.1 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput stated in table 8.5.1.1.1-1 for the single-subcarrier of 3.75KHz subcarrier spacing, in table 8.5.1.1.1-2 for 15KHz subcarrier spacing at the given SNR for 1Tx, and in table 8.5.1.1.1-3 for multi-subcarrier of 15KHz subcarrier spacing at the given SNR for 1Tx.

Table 8.5.1.1.1-1: Minimum requirements for NPUSCH format 1, 200KHz Channel Bandwidth, 3.75KHz subcarrier spacing, 1Tx

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Subcarrier spacing | Number of allocated subcarriers | Propagation conditions and correlation matrix (Annex B) | FRC (Annex A) | Repetition number | Fraction of maximum throughput | SNR  [dB] |
| 1 | 2 | 3.75KHz | 1 | ETU 1Hz Low | A16-1 | 1 | 70% | -1.9 |
| 16 | 70% | -9.2 |
| 64 | 70% | -12.2 |

Table 8.5.1.1.1-2: Minimum requirements for NPUSCH format 1, 200KHz Channel Bandwidth, 15KHz subcarrier spacing, single subcarrier, 1Tx

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Subcarrier spacing | Number of allocated subcarriers | Propagation conditions and correlation matrix (Annex B) | FRC (Annex A) | Repetition number | Fraction of maximum throughput | SNR  [dB] |
| 1 | 2 | 15KHz | 1 | ETU 1Hz Low | A16-2 | 1 | 70% | -2.1 |
| 16 | 70% | -8.8 |
| 64 | 70% | -12.6 |

Table 8.5.1.1.1-3: Minimum requirements for NPUSCH format 1, 200KHz Channel Bandwidth, 15KHz subcarrier spacing, multiple subcarriers, 1Tx

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Subcarrier spacing | Number of allocated subcarriers | Propagation conditions and correlation matrix (Annex B) | FRC (Annex A) | Repetition number | Fraction of maximum throughput | SNR  [dB] |
| 1 | 2 | 15KHz | 3 | ETU 1Hz Low | A16-3 | 2 | 70% | -3.0 |
| 16 | 70% | -8.1 |
| 64 | 70% | -11.4 |
| 6 | ETU 1Hz Low | A16-4 | 2 | 70% | -0.6 |
| 16 | 70% | -6.8 |
| 64 | 70% | -10.5 |
| 12 | ETU 1Hz Low | A16-5 | 2 | 70% | -0.7 |
| 16 | 70% | -6.4 |
| 64 | 70% | -10.1 |

**Table 8.5.1.1.1-4: Minimum requirements for NPUSCH format 1 with two HARQ processes and multiple TBs with interleaved transmission**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Subcarrier spacing | Number of allocated subcarriers | Propagation conditions and correlation matrix (Annex B) | FRC (Annex A) | Repetition number | Fraction of maximum throughput | SNR  [dB] |
| 1 | 2 | 15KHz | 12 | ETU 1Hz Low | A16-6 | 64 | 70% | [-13.9] |

*<Next change>*

## A.16.1 One PRB

Table A.16.1-1: FRC parameters for NB-IoT NPUSCH format 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Reference channel | A16-1 | A16-2 | A16-3 | A16-4 | A16-5 | A16-6 |
| Subcarrier spacing (kHz) | 3.75 | 15 | 15 | 15 | 15 | 15 |
| Number of allocated subcarriers | 1 | 1 | 3 | 6 | 12 | 12 |
| Diversity | No | No | No | No | No | No |
| Modulation | BPSK | BPSK | QPSK | QPSK | QPSK | QPSK |
| ITBS / IRU | 0 / 1 | 0 / 1 | 3 / 0 | 7 / 0 | 9 / 0 | 5/4 |
| Payload size (bits) | 32 | 32 | 40 | 104 | 136 | 424 |
| Allocated resource unit | 2 | 2 | 1 | 1 | 1 | 5 |
| Code rate (target) | 1/3 | 1/3 | 1/3 | 1/3 | 2/3 | 1/3 |
| Code rate (effective) | 0.29 | 0.29 | 0.22 | 0.44 | 0.56 | 0.34 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of code blocks - C | 1 | 1 | 1 | 1 | 1 | 1 |
| Total number of bits per resource unit | 96 | 96 | 288 | 288 | 288 | 1440 |
| Total symbols per resource unit | 96 | 96 | 144 | 144 | 144 | 720 |
| Channel estimation length (ms) Note 1 | 16 | 4 | 4 | 4 | 2 (when repetition = 2)  4 (when repetition > 2) | 4 |
| Note 1: Channel estimation lengths are included in the table for information only. | | | | | | |

*<End of change>*