**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** |  | **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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| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
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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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | Corrections needed on timing relationship enhancement features of Rel-17 NB-IoT/eMTC support for NTN:   1. Editorial correction to re-locate the derivation/description of *K*offsetin timing for eMTC NTN random access procedure clause from towards the end of the clause to the beginning of the clause. 2. Add missing *K*offsetto PUSCH timing relationship for eMTC NTN. 3. Editorial correction to remove italics from subscript in variable *Kmac* for eMTC NTN. 4. Revert previous agreement on application timeline for TA command to include additional *K*offset for NB-IoT NTN. 5. Agreement on using cell-specific offset *K*cell\_offset for PDCCH ordered NPRACH timing relationship for NB-IoT NTN. 6. Add missing *K*offsetto NPUSCH timing relationship for NB-IoT NTN. | | | | | | | | |
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| ***Summary of change:*** | | 1. Clause 6.1.1: re-located the derivation/description of *K*offset in timing for eMTC NTN random access procedure clause to appear at the beginning of the clause. 2. Clause 8.0: Added *K*offsetto PUSCH timing relationship for eMTC NTN. 3. Clause 9.1.5: Removed italics from subscript in variable *Kmac* for eMTC NTN. 4. Clause 16.1.2: Removed additional *K*offset term on application timeline for TA command for NB-IoT NTN. 5. Clause 16.3.2: For PDCCH ordered NPRACH timing relationship for NB-IoT NTN, updated the timing to use cell-specific offset *K*cell\_offset. 6. Clause 16.5.1: Added *K*offsetto NPUSCH timing relationship for NB-IoT NTN. | | | | | | | | |
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| ***Consequences if not approved:*** | | Incorrect operation of Rel-17 NB-IoT/eMTC support for NTN features.   1. Risk of misinterpretation of *K*offsetin timing for eMTC NTN random access procedure as its derivation/description appears later than when first used. 2. Incomplete specification on PUSCH timing relationship for eMTC NTN. 3. Incorrect use of italics in subscript of variable *Kmac* for eMTC NTN. 4. Larger than needed application timeline for TA command for NB-IoT NTN which is inconsistent with previous releases. 5. Incomplete specification on PDCCH ordered NPRACH timing relationship for NB-IoT NTN. 6. Incomplete specification on NPUSCH timing relationship for NB-IoT NTN. | | | | | | | | |
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| ***Clauses affected:*** | | 6.1.1, 8.0, 9.1.5, 16.1.2, 16.3.2, 16.5.1 | | | | | | | | |
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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:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

<Unchanged parts are omitted>

### 6.1.1 Timing

Throughout this clause, f

For the L1 random access procedure, a non-BL/CE UE's uplink transmission timing after a random access preamble transmission is as follows.

a) If a PDCCH with associated RA-RNTI is detected in subframe *n*, and the corresponding DL-SCH transport block contains a response to the transmitted preamble sequence, the UE shall, according to the information in the response, transmit an UL-SCH transport block in the first subframe . If the UE supports reduced control plane latency and *reducedControlPlaneLatency* is enabled, , otherwise, . If the UL delay field in Clause 6.2 is set to zero,  is the first available UL subframe for PUSCH transmission, where for TDD serving cell, the first UL subframe for PUSCH transmission is determined based on the UL/DL configuration (i.e., the parameter *subframeAssignment*) indicated by higher layers. The UE shall postpone the PUSCH transmission to the next available UL subframe after  if the field is set to 1.

b) If a random access response is received in subframe *n*, and the corresponding DL-SCH transport block does not contain a response to the transmitted preamble sequence, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than in subframe .

c) If no random access response is received in subframe *n*, where subframe *n* is the last subframe of the random access response window, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than in subframe , except if the transmitted preamble sequence is on a TDD serving cell not configured for PUSCH/PUCCH transmission.

For the L1 random access procedure, a BL/CE UE's uplink transmission after a random access preamble transmission is as follows.

a) If a MPDCCH with associated RA-RNTI is detected and the corresponding DL-SCH transport block reception ending in subframe *n* contains a response to the transmitted preamble sequence, the UE shall, according to the information in the response, transmit an UL-SCH transport block in the first subframe , , if the UL delay field in Clause 6.2 is set to zero where the subframe is the first available UL subframe for PUSCH transmission, where for TDD serving cell, the first UL subframe for PUSCH transmission is determined based on the UL/DL configuration (i.e., the parameter *subframeAssignment*) indicated by higher layers.

When the number of Msg3 PUSCH repetitions, , as indicated in the random access response, is greater than 1, the subframe is the first available UL subframe in the set of BL/CE UL subframes. The UE shall postpone the PUSCH transmission to the next available UL subframe after , if the UL delay field is set to 1.

When the number of Msg3 PUSCH repetitions,, as indicated in the random access response, is equal to 1, the subframe is the first available UL subframe for PUSCH transmission determined by for FDD and the parameter *subframeAssignment* for TDD. The UE shall postpone the PUSCH transmission to the next available UL subframe after , if the UL delay field is set to 1.

b) If a random access response is received and its reception ends in subframe *n*, and the corresponding DL-SCH transport block does not contain a response to the transmitted preamble sequence, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than in subframe .

c) If the most recent PRACH coverage enhancement level for the UE is 0 or 1,

- if no random access response is received in subframe *n*, where subframe *n* is the last subframe of the random access response window, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than in subframe .

If the most recent PRACH coverage enhancement level for the UE is 2 or 3,

- if no MPDCCH scheduling random access response is received in subframe *n*, where subframe *n* is the last subframe of the random access response window, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than in subframe ;

- if an MPDCCH with associated RA-RNTI is detected and the corresponding DL-SCH transport block reception ending in subframe *n* cannot be successfully decoded, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than in subframe .

In case a random access procedure is initiated by a "PDCCH order" in subframe *n* for non-BL/CE UEs, the UE shall, if requested by higher layers, transmit random access preamble in the first subframe , , where a PRACH resource is available.

In case a random access procedure is initiated by a "PDCCH order" reception ending in subframe *n* for BL/CE UEs, the UE shall, if requested by higher layers, transmit random access preamble in the first subframe ,, where a PRACH resource is available.

If a UE is configured with multiple TAGs, and if the UE is configured with the carrier indicator field for a given serving cell, the UE shall use the carrier indicator field value from the detected "PDCCH order" to determine the serving cell for the corresponding random access preamble transmission.

<Unchanged parts are omitted>

## 8.0 UE procedure for transmitting the physical uplink shared channel

<Unchanged parts are omitted>

A BL/CE UE shall upon detection on a given serving cell of an MPDCCH with DCI format 6-0A/6-0B scheduling PUSCH intended for the UE, perform a corresponding PUSCH transmission in subframe(s) *ni* = *n+ki+Koffset* if a transport block(s) corresponding to the HARQ process(es) of the PUSCH transmission is generated as described in [8] with *i = 0, 1, …, NTBN-1* according to the MPDCCH, where

- subframe *n* is the last subframe in which the MPDCCH is transmitted;

- the value of is the number of scheduled TB determined by the corresponding DCI if present,  otherwise;

*-*  and the value of  is determined by the *repetition number* field in the corresponding DCI, where

- if the UE is configured with higher layer parameter *ce-pdsch-puschEnhancement-config* with value 'On' are given by {1,2,4,8,12,16,24,32}

- otherwise, are given in Table 8-2b and Table 8-2c; and

- if the UE is configured with higher layer parameter *ce-PUSCH-SubPRB-Config-r15*, and the PUSCH resource assignment in the corresponding DCI is using uplink resource allocation type 5,  where *N* ≤ 32 for CE Mode A and *N* ≤ 2048 for CE Mode B,  is defined in [3] and  is determined according to procedure in clause 8.1.6,  otherwise

- in case *N>1*, subframe(s) *n+ki+K*offsetwith *i=0,1,…, NTBN-1* are *NTBN* consecutive BL/CE UL subframe(s) starting with subframe *n+x+K*offset, and in case *N=1*, *k0=x*;

- for ,

<Unchanged parts are omitted>

### 9.1.5 MPDCCH assignment procedure

<Unchanged parts are omitted>

If the UE has initiated a PUSCH transmission using preconfigured uplink resource ending in subframe *n*, the UE shall monitor the MPDCCH UE-specific search space in a search space window starting in subframe *n+4+ K*mac with duration given by higher layer parameter *pur-MPDCCH-SS-window-duration* where  is provided by higher layer parameter *K-mac*, otherwise . Upon detection of a MPDCCH with DCI format 6-0A/6-0B with CRC scrambled by PUR-RNTI intended for the UE within the search space window and the corresponding DCI is for PUR ACK/fallback indication (as defined in [4]), the UE is not required to monitor the MPDCCH UE-specific search space for the remaining search space window duration.

<Unchanged parts are omitted>

### 16.1.2 Timing synchronization

Upon reception of a timing advance command, the UE shall adjust uplink transmission timing for NPUSCH, and SR if configured with higher layer parameter *sr-WithoutHARQ-ACK-Config*, based on the received timing advance command.

The timing advance command indicates the change of the uplink timing relative to the current uplink timing as multiples of 16. The start timing of the random access preamble is specified in [3].

In case of random access response, an 11-bit timing advance command [8], *TA*, indicates *NTA* values by index values of *TA* = 0, 1, 2, ..., 1536, where an amount of the time alignment is given by *NTA* = *TA* ×16. *NTA* is defined in [3].

In other cases, a 6-bit timing advance command [8] or the Timing advance adjustment field in DCI format N0 if present [4], *TA*, indicates adjustment of the current *NTA* value, *NTA,old*, to the new *NTA* value, *NTA,new*, by index values of *TA* = 0, 1, 2,..., 63, where *NTA,new* = *NTA,old* + (*TA* −31)×16. Here, adjustment of *NTA* value by a positive or a negative amount indicates advancing or delaying the uplink transmission timing by a given amount respectively.

For a timing advance command reception ending in DL subframe *n*, the corresponding adjustment of the uplink transmission timing shall apply from the first available NB-IoT uplink slot following the end of *n+12* DL subframe and the first available NB-IoT uplink slot is the first slot of a NPUSCH transmission*.* When the UE's uplink NPUSCH transmissions in NB-IoT uplink slot *n* and NB-IoT uplink slot *n*+1 are overlapped due to the timing adjustment, the UE shall complete transmission of NB-IoT uplink slot *n* and not transmit the overlapped part of NB-IoT uplink slot *n*+1.

If the received downlink timing changes and is not compensated or is only partly compensated by the uplink timing adjustment without timing advance command as specified in [10], the UE changes *NTA* accordingly.

<Unchanged parts are omitted>

### 16.3.2 Timing

For the L1 random access procedure, UE's uplink transmission timing after a random access preamble transmission is as follows.

a) If a NPDCCH with associated RA-RNTI is detected and the corresponding DL-SCH transport block ending in subframe *n* contains a response to the transmitted preamble sequence, the UE shall, according to the information in the response, transmit an UL-SCH transport block according to Clause 16.3.3.

b) If a random access response is received and the corresponding DL-SCH transport block ending in subframe *n* does not contain a response to the transmitted preamble sequence, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than the NB-IoT UL slot starting 12 milliseconds after the end of subframe *n*.

c) If no NPDCCH scheduling random access response is received in subframe *n*, where subframe *n* is the last subframe of the random access response window, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than the NB-IoT UL slot starting 12 milliseconds after the end of subframe *n*.

d) If an NPDCCH scheduling random access response with associated RA-RNTI is detected and the corresponding DL-SCH transport block reception ending in subframe *n* cannot be successfully decoded, the UE shall, if requested by higher layers, be ready to transmit a new preamble sequence no later than the NB-IoT UL slot starting 12 milliseconds after the end of subframe *n*.

In case a random access procedure is initiated by a "PDCCH order" ending in subframe *n*, the UE shall, if requested by higher layers, start transmission of random access preamble at the end of the first subframe , , where a NPRACH resource is available.

The "PDCCH order" in DCI format N1 indicates to the UE,

- allocated subcarrier for NPRACH, where  is the subcarrier indication field in the corresponding DCI, is reserved for preamble format 0/1, is reserved for preamble format 2 if *nprach-ParametersListFmt2* is configured and the UE indicates the *nprach-Format2* capability and Preamble format indicator is set to 1.

- a repetition number () for NPRACH determined by the repetition number field () in the corresponding DCI according to Table 16.3.2-1 where R1, R2 (if any) and R3 (if any) are given by the higher layer parameter *numRepetitionsPerPreambleAttempt* for each NPRACH resource, respectively. R1 < R2 <R3.

<Unchanged parts are omitted>

### 16.5.1 UE procedure for transmitting format 1 narrowband physical uplink shared channel

NPUSCH format 1 transmission can be scheduled by a NPDCCH with DCI format N0, or the transmission can correspond to using preconfigured uplink resource configured by higher layers. Transmission using preconfigured uplink resource is initiated by higher layers as specified in [14] , while retransmission of transport blocks transmitted using preconfigured uplink resource are scheduled by a NPDCCH with DCI format N0.

A UE shall upon detection on a given serving cell of a NPDCCH with DCI format N0 ending in NB-IoT DL subframe *n* scheduling NPUSCH intended for the UE, perform, at the end of

*- n+k0**+K*offset DL subframe for FDD,

*- k0* NB-IoT UL subframes following the end of *n+*8*+K*offset subframefor TDD,

a corresponding NPUSCH transmission using NPUSCH format 1 in *N* consecutive NB-IoT UL slots *ni* with *i = 0, 1, …, N-1* according to the NPDCCH information where

- subframe *n* is the last subframe in which the NPDCCH is transmitted and is determined from the starting subframe of NPDCCH transmission and the DCI subframe repetition number field in the corresponding DCI; and

- , where the value of is determined by the repetition number field in the corresponding DCI (see Clause 16.5.1.1), the value of is determined by the resource assignment field in the corresponding DCI (see Clause 16.5.1.1), the value of  is the number of NB-IoT UL slots of the resource unit (defined in clause 10.1.2.3 of [3]) corresponding to the  allocated number of subcarriers (as determined in Clause 16.5.1.1) in the corresponding DCI, and the value of is determined by the Number of scheduled TB for Unicast field, if present, in the corresponding DCI,  otherwise

- *n0* is the first NB-IoT UL slot starting after the end of subframe *n+k0+K*offset for FDD

- *n0* is the first NB-IoT UL slot starting after *k0* NB-IoT UL subframes following the end of *n*+8*+K*offset subframe for TDD

- value of *k0* is determined by the scheduling delay field () in the corresponding DCI according to Table 16.5.1-1 for FDD and Table 16.5.1-1A for TDD

<Unchanged parts are omitted>