**3GPP TSG-WG1 Meeting # 110-e *R1-221xxxx***

**e-Meeting, October 10th - October 19th, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **36.213** | **CR** | **xxx** | **rev** | **-** | **Current version:** | **17.3.0** |  |
|  | | | | | | | | |
| *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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| ***Title:*** | Editorial corrections to NB-IoT/eMTC support for Non-Terrestrial Networks | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Motorola Mobility | | | | | | | | | |
| ***Source to TSG:*** | RAN1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_NBIOT\_eMTC\_NTN-Core | | | | |  | ***Date:*** | | | 2022-10-24 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Corrections on time/frequency synchronization and timing relationship enhancement features of Rel-17 NB-IoT/eMTC support for NTN:  ancement features of Rel-17 NB-IoT/eMTC support for NTN:   1. Clarify support of network re-configuration of UL transmission segment by dedicated RRC Signalling in clause 4.2.3 for eMTC, and clause 16.1.2 for NB-IoT 2. Misaligned higher layer parameter names *CellSpecificKoffset* and *UESpecificKoffset* in clauses 4.2.3, 5.1.1.1, 6.1.1, 7.2.3, 7.3, 8, 10, and 16. 3. Delete duplicate definition of *K*mac in clause 16.6 4. Missing *K*offset in index of PDSCH subframe in clause 7.3.1 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Changed "system information" to "higher layers" in clause 4.2.3 and 16.1.2. Added reference to TS 36.331 specification. 2. Changed higher layer parameter names *CellSpecificKoffset* to *k-Offset* and *UESpecificKoffset* to *Differential Koffset* in clauses 4.2.3, 5.1.1.1, 6.1.1, 7.2.3, 7.3, 8, 10, and 16. 3. Removed duplicate definition of *K*mac in clause 16.6 4. Included *K*offset in index of PDSCH subframe in clause 7.3.1 | | | | | | | | |
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| ***Consequences if not approved:*** | | Inconsistent specification of Rel-17 NB-IoT/eMTC support for NTN features. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.2.3, 5.1.1.1, 6.1.1, 7.2.3, 7.3, 7.3.1, 8, 10, 16, 16.1.2, 16.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Unchanged parts are omitted>

### 4.2.3 Transmission timing adjustments

<Unchanged parts are omitted>

For a BL/CE UE, for a timing advance command received on subframe *n*, the corresponding adjustment of the uplink transmission timing shall apply for the uplink PUCCH/PUSCH/SRS transmissions in subframe *n+6+Koffset*. When the BL/CE UE's uplink PUCCH/PUSCH/SRS transmissions in subframe *n* and subframe *n*+1 are on the same narrowband and are overlapped due to the timing adjustment, the UE shall complete transmission of subframe *n* and is not required to transmit in subframe *n+1* until the first available symbol that has no overlapping portion with subframe *n*. When the BL/CE UE's uplink PUCCH/PUSCH/SRS transmissions in subframe *n* and subframe *n*+1 are on different narrowbands, and the timing adjustment occurs in the guard period for narrowband retuning, the UE is not required to transmit in subframe *n+1* until the first available symbol that has no overlapping portion with subframe *n* and which does not reduce the guard period. The value of is given by,

- if the UE is configured with the higher layer parameter *k-Offset,*

- where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

- otherwise,

- .

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.

For a BL/CE UE in a NTN serving cell, using serving satellite higher-layer ephemeris parameters, if configured, the BL/CE UE determines  (defined in [3]) using the serving satellite position and its own position to pre-compensate the two-way transmission delay on the service link. To pre-compensate the two-way transmission delay between the uplink time synchronization reference point and the serving satellite, the BL/CE UE determines (defined in [3]) based on one-way propagation delay which can be obtained as:

where , , and are given by the higher layer parameters *nta-Common*, *nta-CommonDrift*, and *nta-CommonDriftVariation* respectively, and is the epoch time given by the higher layer parameter *epochTime*. provides a distance at time between the serving satellite and the uplink time synchronization reference point divided by the speed of light. The uplink time synchronization reference point is the point where DL and UL are frame aligned with an offset given by .

For a BL/CE UE communicating over NTN, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of time units, where the quantity is provided by higher layers, as specified in 3GPP TS 36.331 [11].



<Unchanged parts are omitted>

#### 5.1.1.1 UE behaviour

The setting of the UE Transmit power for a Physical Uplink Shared Channel (PUSCH) transmission is defined as follows.

<Unchanged parts are omitted>

-  is a correction value, also referred to as a TPC command and is included in PDCCH/EPDCCH with DCI format 0/0A/0B/0C/4/4A/4B or in PDCCH/SPDCCH with DCI format 7-0A/7-0B or in MPDCCH with DCI format 6-0A for serving cell or jointly coded with other TPC commands in PDCCH/MPDCCH with DCI format 3/3A whose CRC parity bits are scrambled with TPC-PUSCH-RNTI. If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell  and if subframe  belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-SubframeSet-r12,* the current PUSCH power control adjustment state for serving cell is given by, and the UE shall use  instead of to determine . Otherwise, the current PUSCH power control adjustment state for serving cell is given by. If the UE is configured with multiple UL SPS configurations,  is a correction value, also referred to as a TPC command and is jointly coded with other TPC commands in PDCCH with DCI format 3/3A whose CRC parity bits are scrambled with TPC-PUSCH-RNTI, where x is *SPS-ConfigIndex-r14*, and  and  are replaced by  and , respectively.

-  and  if accumulation is enabled based on the parameter *Accumulation-enabled* or *accumulationEnabledsTTI* provided by higher layers or if the TPC command  is included in a PDCCH/EPDCCH with DCI format 0 or in a MPDCCH with DCI format 6-0A for serving cell  where the CRC is scrambled by the Temporary C-RNTI or PUR-RNTI

-  and  if accumulation is enabled based on the parameter *Accumulation-enabled* or *accumulationEnabledsTTI* provided by higher layers and if the TPC command  is included in a PDCCH with DCI format 3/3A whose CRC parity bits are scrambled by TPC-PUSCH-RNTI and if the UE is configured with multiple UL SPS configurations.

- where was signalled on PDCCH/EPDCCH with DCI format 0/0A/0B/0C/4/4A/4B or PDCCH/SPDCCH with DCI format 7-0A/7-0B or MPDCCH with DCI format 6-0A or PDCCH/MPDCCH with DCI format 3/3A on subframe/slot/subslot , and where  is the first value after reset of accumulation. For a BL/CE UE configured with CEModeA, subframe  is the last subframe in which the MPDCCH with DCI format 6-0A or MPDCCH with DCI format 3/3A is transmitted.

- The value of for a BL/CE UE is

- if the UE is configured with the higher layer parameter *k-Offset,*

- where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

- otherwise,

- .

- The value of  is

- For FDD or FDD-TDD and serving cell frame structure type 1

- if the UE is configured with higher layer parameter *shortTTI* andthe TPC command  is included in a PDCCH/ SPDCCH with DCI format 7-0A/7-0Band for PUSCH transmissions in a subslot, 

<Unchanged parts are omitted>

### 6.1.1 Timing

Throughout this clause, for a BL/CE UE, if the UE is configured with the higher layer parameter *k-Offset,*

- where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

otherwise,

- , .

<Unchanged parts are omitted>

### 7.2.3 Channel Quality Indicator (CQI) definition

<Unchanged parts are omitted>

The CSI reference resource for a serving cell is defined as follows:

- For a non-BL/CE UE, in the frequency domain, the CSI reference resource is defined by the group of downlink physical resource blocks corresponding to the band to which the derived CQI value relates. For a BL/CE UE, in the frequency domain, the CSI reference resource includes all downlink physical resource blocks for any of the narrowband to which the derived CQI value relates.

<Unchanged parts are omitted>

- In the time domain and for a BL/CE UE, the CSI reference resource is defined by a set of BL/CE downlink or special subframes where the last subframe is subframe *n*-*nCQI\_ref -K*offset,

- where is given by,

- if the UE is configured with the higher layer parameter *k-Offset,*

-  where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

- otherwise,

- ;

- where for periodic CSI reporting *nCQI\_ref* is ≥ 4;

- where for aperiodic CSI reporting *nCQI\_ref* is ≥ 4;

where each subframe in the CSI reference resource is a valid downlink or valid special subframe;

- where for wideband CSI reports:

- The set of BL/CE downlink or special subframes is the set of the last  subframes before *n*-*nCQI\_ref* -*K*offsetused for MPDCCH monitoring by the BL/CE UE in each of the narrowbands where the BL/CE UE monitors MPDCCH, where  is the number of narrowbands where the BL/CE UE monitors MPDCCH.

- where for subband CSI reports:

- The set of BL/CE downlink or special subframes is the set of the last subframes used for MPDCCH monitoring by the BL/CE UE in the corresponding narrowband before *n*-*nCQI\_ref* -*K*offset;

- where is given by the "repetition" column when UE is configured to report the CQI according to Table 7.2.3-6, otherwise by the higher layer parameter *csi-NumRepetitionCE*.

<Unchanged parts are omitted>

## 7.3 UE procedure for reporting HARQ-ACK

<Unchanged parts are omitted>

Throughout this clause,

- if the UE is configured with higher layer parameter *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI is in the UE-specific search space*,* and **otherwise.

- if the UE is configured with higher layer parameter *shortTTI* and for PDSCH transmissions in a subslot, ** is determined based on higher layer parameter proc-Timeline-r15, where

- **= 4 if *proc-Timeline-r15* is set to 'nplus4set1'

- **= 6 if *proc-Timeline-r15* is set to 'nplus6set1' or 'nplus6set2'

- **= 8 if *proc-Timeline-r15* is set to 'nplus8set2'

- for a BL/CE UE, the value of is given by,

- if the UE is configured with the higher layer parameter *k-Offset,*

- where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

- otherwise,

- .

<Unchanged parts are omitted>

### 7.3.1 FDD HARQ-ACK reporting procedure

For FDD with PUCCH format 1a/1b transmission, when both HARQ-ACK and SR are transmitted in the same sub-frame/slot, a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH format 1a/1b resource for a negative SR transmission and transmit the HARQ-ACK on its assigned SR PUCCH resource for a positive SR transmission.

<Unchanged parts are omitted>

For a BL/CE UE with higher layer parameter *ce-PDSCH-14HARQ-Config* configured, for PDSCH transmission in subframe *n-k*-*K*offset, if the UE is in half-duplex FDD operation and is configured with CEModeA, and 'PDSCH scheduling delay and HARQ-ACK delay for 14 HARQ' field is present in the corresponding DCI,

- if the HARQ-ACK delay value as defined in [4], in the corresponding DCI indicates value *k*, the UE shall determine the subframe *n* as the HARQ-ACK transmission subframe.

For a BL/CE UE in half-duplex FDD operation, if the UE is configured with CEModeA, and if the UE is configured with higher layer parameter *ce-HARQ-AckBundling* and the 'HARQ-ACK bundling flag' in the corresponding DCI is set to 1,

- for HARQ-ACK transmission in subframe *n*, the UE shall generate one HARQ-ACK bit by performing a logical AND operation of HARQ-ACKs across all  BL/CE DL subframes for which subframe *n* is the 'HARQ-ACK transmission subframe'.

- if subframe *n-k1-K*offset is the most recent subframe for which subframe *n* is the 'HARQ-ACK transmission subframe', and if the 'Transport blocks in a bundle' field in the corresponding DCI for PDSCH transmission in subframe *n-k1-K*offset indicates a number of transport blocks in a bundle other than , the UE shall generate a NACK for HARQ-ACK transmission in subframe *n*.

- if the UE has received *W* PDSCH transmissions before subframe *n*, and if the UE is expected to transmit HARQ-ACK for the *W* PDSCH transmissions in subframes , the UE is not expected to receive a new PDSCH transmission in subframe *n*, where *W*=10 if higher layer parameter *ce-pdsch-tenProcesses-config* is set to '*On*', *W*=12 if higher layer parameter *ce-PDSCH-14HARQ-Config* is configured, and *W*=8 otherwise.

- if the UE is expected to transmit HARQ-ACK for the PDSCH transmissions received before subframe *n* in subframes , the UE is not expected to receive a new PDSCH transmission in subframe *n* for which the HARQ-ACK is to be transmitted in subframe 

<Unchanged parts are omitted>

# 8 Physical uplink shared channel related procedures

<Unchanged parts are omitted>

Throughout this clause, for a BL/CE UE, the value of is given by,

- if the UE is configured with the higher layer parameter *k-Offset,*

- where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

- otherwise,

- .

<Unchanged parts are omitted>

# 10 Physical uplink control channel procedures

<Unchanged parts are omitted>

Throughout this clause,

- if the UE is configured with higher layer parameter *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI is in the UE-specific search space*, * and **otherwise,

- if the UE is configured with higher layer parameter *shortTTI* and the corresponding PDCCH/SPDCCH with DCI format 7-1A/7-1B/7-1C/7-1D/7-1E/7-1F/7-1G is detected in a subslot, ** is determined based on higher layer parameter *min-proc-TimelineSubslot* from **.

- for a BL/CE UE, the value of is given by,

- if the UE is configured with the higher layer parameter *k-Offset,*

- where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

- otherwise,

- .

<Unchanged parts are omitted>

# 16 UE Procedures related to narrowband IoT

Throughout this clause,

- for a NB-IoT UE, the value of is given by,

- if the UE is configured with the higher layer parameter *k-Offset,*

- where

is the parameter *k-Offset* provided by higher layers, and

is the parameter *Differential Koffset* provided by higher layers, otherwise

- otherwise,

- .

<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.

For a UE in a NTN serving cell, using serving satellite higher-layer ephemeris parameters, if configured, the UE determines  (defined in [3]) using the serving satellite position and its own position to pre-compensate the two-way transmission delay on the service link. To pre-compensate the two-way transmission delay between the uplink time synchronization reference point and the serving satellite, the UE determines (defined in [3]) based on one-way propagation delay which can be obtained as:

where , , and are given by the higher layer parameters *nta-Common*, *nta-CommonDrift*, and *nta-CommonDriftVariation* respectively, and is the epoch time given by the higher layer parameter *epochTime*. provides a distance at time between the serving satellite and the uplink time synchronization reference point divided by the speed of light. The uplink time synchronization reference point is the point where DL and UL are frame aligned with an offset given by .

For a NB-IoT UE communicating over NTN, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of time units, where the quantity is provided by higher layers, as specified in 3GPP TS 36.331 [11].

<Unchanged parts are omitted>

## 16.6 Narrowband physical downlink control channel related procedures

<Unchanged parts are omitted>

For UE-specific search space by PUR-RNTI, the UE is configured by the higher layer parameter *carrierConfig* in *PUR-Config-NB* with a NB-IoT carrier for monitoring of NPDCCH UE-specific search space,

- the UE shall monitor the NPDCCH UE-specific search space on the higher layer configured NB-IoT carrier,

- the UE is not expected to receive NPSS, NSSS, NPBCH on the higher layer configured NB-IoT carrier if the NB-IoT carrier is not the same as the NB-IoT carrier on which NPSS/NSSS/NPBCH are detected.

If the UE has initiated a NPUSCH transmission using preconfigured uplink resource ending in subframe *n*, the UE shall monitor the NPDCCH UE-specific search space in a search space window starting in subframe *n+4+**K*mac with duration given by higher layer parameter *pur-SS-window-duration*. Upon detection of a NPDCCH with DCI format N0 with CRC scrambled by PUR-RNTI intended for the UE within the search space window and the value of "modulation and coding scheme" field () in the corresponding DCI is set to '14', the UE is not required to monitor the NPDCCH UE-specific search space for the remaining search space window duration.

<Unchanged parts are omitted>