**3GPP TSG RAN WG1 Meeting #103-e R1-200xxxx**

**e-Meeting, October 26 – November 13, 2020**

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| *CR-Form-v12.0* |
| **DRAFT CHANGE REQUEST** |
|  |
|  | **36.213** | **CR** | **xxx** | **rev** | **-** | **Current version:** | **16.3.0** |  |
|  |
| *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 | **x** | Radio Access Network | **x** | Core Network |  |

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|  |
| ***Title:***  | Alignment of terminology for Rel-16 Additional MTC Enhancements for LTE  |
|  |  |
| ***Source to WG:*** | Lenovo, Motorola Mobility |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | LTE\_eMTC5-Core |  | ***Date:*** | 2020-11-11 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***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 canbe 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)* |
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| ***Reason for change:*** | Alignment of terminology between specifications. |
|  |  |
| ***Summary of change:*** | 1. [103-e-LTE-eMTC5-03] Change PUR C-RNTI/PUR RNTI to PUR-RNTI (R1-2008583 section 2.3)
2. [103-e-LTE-eMTC5-03] Change paramter name *harq-Bundling* to *harq-AckBundling* (R1-2008692 Issue #3)
3. [103-e-LTE-eMTC5-03] Change “resourceReservationDedicated[DL/UL] is configured” with “[DL/UL] resource reservation is enabled for the UE as specified in [TS36.331]” (R1-2009296).
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| ***Consequences if not approved:*** | Incorrect terminology between specifications. |
|  |  |
| ***Clauses affected:*** |  5.1.1.1, 5.1.2.1, 7.1, 8.0, 9.1.5, 9.1.5.3, 7.3, 10.2  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 36.211 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

#### 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.

If the UE transmits PUSCH without a simultaneous PUCCH for the serving cell , then the UE transmit power  for PUSCH transmission in subframe/slot/subslot *i* for the serving cell is given by

 [dBm]

If the UE transmits PUSCH simultaneous with PUCCH for the serving cell , then the UE transmit power  for the PUSCH transmission in subframe/slot/subslot *i* for the serving cell  is given by

 [dBm]

If the UE is not transmitting PUSCH for the serving cell c, for the accumulation of TPC command received with DCI format 3/3A for PUSCH, the UE shall assume that the UE transmit power  for the PUSCH transmission in subframe *i* for the serving cell  is computed by

 [dBm]

where,

- is the configured UE transmit power defined in [6] in subframe/slot/subslot *i* for serving cell  and  is the linear value of . If the UE transmits PUCCH without PUSCH in subframe for the serving cell c, for the accumulation of TPC command received with DCI format 3/3A for PUSCH, the UE shall assume  as given by Subclause 5.1.2.1. If the UE does not transmit PUCCH and PUSCH in subframe  for the serving cell c, for the accumulation of TPC command received with DCI format 3/3A for PUSCH, the UE shall compute  assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB and TC =0dB, where MPR, A-MPR, P-MPR and TC are defined in [6].

-  is the linear value of defined in Subclause 5.1.2.1

- If the UE is a BL/CE UE configured with higher layer parameter *ce-PUSCH-SubPRB-Config-r15*, and the PUSCH resource assignment valid for subframe *i* and serving cell is using uplink resource allocation type 5, is the bandwidth of the PUSCH resource assignment expressed in fraction of a resource block and is given by  where  are defined in [3] and is defined in Subclause 8.6.1 for subframe *i,* is the bandwidth of the PUSCH resource assignment expressed in number of resource blocks valid for subframe/slot/subslot *i* and serving cell otherwise.

- 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*,

- when j=0, , where j=0 is used for PUSCH (re)transmissions corresponding to a semi-persistent grant. and  are the parameters *p0-UE-PUSCH-Persistent-SubframeSet2-r12 and* *p0-NominalPUSCH-Persistent -SubframeSet2-r12* respectively provided by higher layers, for each serving cell .

- when j=1,, where j=1 is used for PUSCH (re)transmissions corresponding to a dynamic scheduled grant. and are the parameters *p0-UE-PUSCH-SubframeSet2-r12 and p0-NominalPUSCH-SubframeSet2-r12* respectively, provided by higher layers for serving cell *.*

- when j=2, where  and , where the parameter *preambleInitialReceivedTargetPower* [8] () and  are signalled from higher layers for serving cell , where j=2 is used for PUSCH (re)transmissions corresponding to the random access response grant.

 Otherwise

- is a parameter composed of the sum of a component  provided from higher layers for *j=0,* *1* and *3* and a component  provided by higher layers for *j=0,* *1* and *3* for serving cell . For PUSCH (re)transmissions corresponding to a semi-persistent grant then *j=0* , for PUSCH (re)transmissions corresponding to a dynamic scheduled grant then *j=1,* for PUSCH (re)transmissions corresponding to the random access response grant then *j=2* and for BL/CE UE PUSCH (re)transmission using preconfigured uplink resource then *j=3*.  and , where the parameter *preambleInitialReceivedTargetPower* [8] () and  are signalled from higher layers for serving cell .

- 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*,

- For *j*=0 or 1, . is the parameter *alpha-SubframeSet2-r12* provided by higher layers for each serving cell.

- For *j*=2, .

- Else if the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v15x0* for serving cell *c*,

- For *j*=0 or 1, . is the parameter *alpha-UE-r15* provided by higher layers for each serving cell.

- For *j*=2, .

 Otherwise

- For *j* =0 or *1*,  is a 3-bit parameter provided by higher layers for serving cell. For *j*=2,  For *j*=*3*,  is the parameter *pur-PUSCH-power-control-alpha* provided by higher layers for serving cell.

-  is the downlink path loss estimate calculated in the UE for serving cell  in dB and  = *referenceSignalPower* – higher layer filtered RSRP, where *referenceSignalPower* is provided by higher layers and RSRP is defined in [5] for the reference serving cell and the higher layer filter configuration is defined in [11] for the reference serving cell.

- If serving cell  belongs to a TAG containing the primary cell then, for the uplink of the primary cell, the primary cell is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP. For the uplink of the secondary cell, the serving cell configured by the higher layer parameter *pathlossReferenceLinking* defined in [11] is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP.

- If serving cell  belongs to a TAG containing the PSCell then, for the uplink of the PSCell, the PSCell is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP; for the uplink of the secondary cell other than PSCell, the serving cell configured by the higher layer parameter *pathlossReferenceLinking* defined in [11] is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP.

- If serving cell  belongs to a TAG not containing the primary cell or PSCell then serving cell  is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP.

- for and 0 for where  is given by the parameter *deltaMCS-Enabled* provided by higher layers for each serving cell .  and , for each serving cell , are computed as below.  for transmission mode 2.

- for control data sent via subframe-PUSCH without UL-SCH data or slot/sublot-PUSCH without UL-SCH data if the UE is configured with a higher layer parameter *uplinkPower-CSIPayload,*  and withdefined as the number of CQI/PMI bits including CRC for a given RI value for slot/subslot-PUSCH without UL-SCH data if the UE is not configured with a higher layer parameter *uplinkPower-CSIPayload*, and *BPRE=*  for other cases.

- where  is the number of code blocks,  is the size for code block ,  is the number of CQI/PMI bits including CRC bits and  is the number of resource elements determined as , where , ,  and  are defined in [4].

-  for control data sent via PUSCH without UL-SCH data and  for other cases.

-  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  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, 

- the UE is configured with higher layer parameters *dl-STTI-Length='subslot'* and *ul-STTI-Length='slot'* andthe TPC command  is included in a PDCCH/ SPDCCH with DCI format 7-0A/7-0B and for PUSCH transmissions in a slot, corresponds to:

- a subslot among subslot *4* or *5* of subframe *N-3* or subslot *0* of subframe *N-2* in which the UE has received the TPC command if the slot PUSCH is to be transmitted in slot *0* of subframe *N*. A UE is not expected to receive TPC command in more than one subslot among subslot *4* or *5* of subframe *N-3* or subslot *0* of subframe *N-2* corresponding to slot-PUSCH transmission in slot *0* of subframe *N*.

- a subslot among subslot *1* or *2* or *3* of subframe *N-2* in which the UE has received the TPC command if the slot-PUSCH is to be transmitted in slot *1* of subframe *N*. A UE is not expected to receive TPC command in more than one subslot among subslot *1* or *2* or *3* of subframe *N-2* corresponding to slot-PUSCH transmission in slot *1*of subframe *N*.

- 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, 

- otherwise,  = 4 (in unit of slots for slot-PUSCH and the TPC command is included in a PDCCH/ SPDCCH with DCI format 7-0A/7-0B, and in units of subframe for subframe-PUSCH and for slot/subslot-PUSCH with a TPC commandprovided in the PDCCH with DCI format 3/3A).

- For TDD, if the UE is configured with more than one serving cell and the TDD UL/DL configuration of at least two configured serving cells is not the same, or if the UE is configured with the parameter *EIMTA-MainConfigServCell-r12* for at least one serving cell, or for FDD-TDD and serving cell frame structure type 2, the "TDD UL/DL configuration" refers to the UL-reference UL/DL configuration (defined in Subclause 8.0) for serving cell .

- For TDD UL/DL configurations 1-6 and UE not configured with higher layer parameter *symPUSCH-UpPts-r14* for the serving cell ,  is given

- in Table 5.1.1.1-1A 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 for subframe-PUSCH transmissions,

- in Table 5.1.1.1-1B for special subframe configuration 1, 2, 3, 4, 6, 7, 8 and Table 5.1.1.1-1C for special subframe configuration 0, 5, 9 if the UE is configured with higher layer parameter *shortTTI* andthe TPC command  is included in a PDCCH/ SPDCCH with DCI format 7-0A/7-0B, and for uplink transmissions in a slot,

- by  if the slot-PUSCH transmission in slot 15 or 16 is scheduled with a PDCCH/SPDCCH with DCI format 7-0A/7-0B in which the LSB of the UL index is set to 1 for TDD UL/DL configuration 6 and special subframe configuration 0, 5, 9,

- in Table 5.1.1.1-1 otherwise.

- For TDD UL/DL configuration 0 and UE not configured with higher layer parameter *symPUSCH-UpPts-r14* for the serving cell .

- If the subframe-PUSCH transmission in subframe *2* or *7* isscheduledwith a PDCCH/EPDCCH of DCI format 0/4 or a MPDCCH of DCI format 6-0A in which the LSB of the UL index is set to 1, = 7

- For slot-PUSCH transmissions, is given by Table 5.1.1.1-1B for special subframe configuration 1, 2, 3, 4, 6, 7, 8 and Table 5.1.1.1-1C for special subframe configuration 0, 5, 9 ifthe TPC command  is included in a PDCCH/ SPDCCH with DCI format 7-0A/7-0B. If the TPC command  is provided in the PDCCH with DCI format 3/3A,  is given in Table 5.1.1.1-1.

- For all other subframe-PUSCH transmissions,  is given in Table 5.1.1.1-1A if the UE is configured with *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI is in the UE-specific search space, otherwise Table 5.1.1.1-1.

- For TDD UL/DL configurations 0-5 and UE configured with higher layer parameter *symPUSCH-UpPts-r14* for the serving cell ,  is given in

- Table 5.1.1.1-4A if the UE is configured with *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI is in the UE-specific search space,

- Table 5.1.1.1-4B for slot-PUSCH transmissions ifthe TPC command  is included in a PDCCH/ SPDCCH with DCI format 7-0A/7-0B,

- Table 5.1.1.1-4 otherwise.

- For TDD UL/DL configuration 6 and UE configured with higher layer parameter *symPUSCH-UpPts-r14* for the serving cell 

* If the subframe-PUSCH transmission in subframe *2* or *7* isscheduledwith a PDCCH/EPDCCH of DCI format 0/4 if the UE is not configured with higher layer parameter *shortProcessingTime* or if the UE is configured with higher layer parameter *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI is in the common search space in which the LSB of the UL index is set to 1, = 6

- For all other PUSCH transmissions,  is given in

* Table 5.1.1.1-4A if the UE is configured with *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI is in the UE-specific search space,
* Table 5.1.1.1-4B for slot-PUSCH transmissions ifthe TPC command  is included in a PDCCH/ SPDCCH with DCI format 7-0A/7-0B,

- Table 5.1.1.1-4 otherwise.

- For a serving cell with frame structure type 3,

- For an uplink DCI format 0A/4A carrying AUL-DFI according to subclause 8.3A, =4.

- For an uplink DCI format 0A/0B/0C/4A/4B with CRC scrambled by C-RNTI with PUSCH trigger A set to 0, is equal to *k*+*l*, where *k* and *l* are defined in in Subclause 8.0.

- For an uplink DCI format 0A/0B/0C/4A/4B with CRC scrambled by C-RNTI with PUSCH trigger A set to 1 and upon the detection of PDCCH with CRC scrambled by CC-RNTI and with 'PUSCH trigger B' field set to '1' described in Subclause 8.0, is equal to *p*+*k*+*l*, where *p*, *k* and *l* are defined in Subclause 8.0.

* If a UE detected multiple TPC commands in subframe , the UE shall use the TPC command in the PDCCH/EPDCCH with DCI format 0A/0B/0C/4A/4B with CRC scrambled by C-RNTI which schedules PUSCH transmission in subframe *i*.

- For serving cell  and a non-BL/CE UE, the UE attempts to decode a PDCCH/EPDCCH of DCI format 0/0A/0B/0C/4/4A/4B or a PDCCH/SPDCCH of DCI format 7-0A/7-0B with the UE's C-RNTI or a PDCCH/EPDCCH of DCI format 0 for SPS C-RNTI or a PDCCH/SPDCCH of DCI format 7-0A/7-0B for SPS C-RNTI or a PDCCH/EPDCCH of DCI format 0 for UL-SPS-V-RNTI and a PDCCH of DCI format 3/3A with this UE's TPC-PUSCH-RNTI in every subframe except when in DRX or where serving cell is deactivated.

* For serving cell  and a BL/CE UE configured with CEModeA, the UE attempts to decode a MPDCCH of DCI format 6-0A with the UE's C-RNTI or SPS C-RNTI or PUR-RNTI and a MPDCCH of DCI format 3/3A with this UE's TPC-PUSCH-RNTI in every BL/CE downlink subframe except when in DRX

<Unchanged parts are omitted>

#### 5.1.2.1 UE behaviour

If serving cell is the primary cell, for PUCCH format 1/1a/1b/2/2a/2b/3, the setting of the UE Transmit powerfor the physical uplink control channel (PUCCH) transmission in subframe/slot/subslot *i* for serving cell  is defined by

 [dBm]

If serving cell is the primary cell, for PUCCH format 4/5, the setting of the UE Transmit powerfor the physical uplink control channel (PUCCH) transmission in subframe/slot/subslot *i* for serving cell  is defined by

 [dBm]

If the UE is not transmitting PUCCH for the primary cell, for the accumulation of TPC command for PUCCH, the UE shall assume that the UE transmit power  for PUCCH in subframe/slot/subslot *i* is computed by

 [dBm]

where

- is the configured UE transmit power defined in [6] in subframe/slot/subslot i for serving cell . If the UE transmits PUSCH without PUCCH in subframe  for the serving cell c, for the accumulation of TPC command for PUCCH, the UE shall assume  as given by Subclause 5.1.1.1. If the UE does not transmit PUCCH and PUSCH in subframe/slot/subslot  for the serving cell c, for the accumulation of TPC command for PUCCH, the UE shall compute  assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB and TC =0dB, where MPR, A-MPR, P-MPR and TC are defined in [6].

- The parameter  is provided by higher layers. Each  value corresponds to aPUCCH format (*F*) relative to subframe-PUCCH format 1a, where each PUCCH format (*F* ) is defined in Table 5.4-1 of [3] for subframe-PUCCH, in Table 5.4A-1 of [3] for slot-PUCCH, and in Table 5.4A-2 of [3] for subslot-PUCCH.

- If the UE is configured by higher layers to transmit PUCCH on two antenna ports, the value of is provided by higher layers where each PUCCH format *F'* is defined in Table 5.4-1 of [3] for subframe-PUCCH, in Table 5.4A-1 of [3] for slot-PUCCH, and in Table 5.4A-2 of [3] for subslot-PUCCH; otherwise, .

-  is a PUCCH format dependent value, where  corresponds to the number of information bits for the channel quality information defined in Subclause 5.2.3.3 in [4].  = 1 if subframe/slot/subslot *i* is configured for SR for the UE not having any associated transport block for UL-SCH, otherwise =0. If the UE is configured with more than one serving cell, or the UE is configured with one serving cell and transmitting using PUCCH format 3, the value of  is defined in Subclause 10.1; otherwise,  is the number of HARQ-ACK bits sent in subframe/slot/subslot *i*.

- For subframe-PUCCH format 1,1a and 1b 

- For PUCCH format 1b with channel selection, if the UE is configured with more than one serving cell, , otherwise, 

- For PUCCH format 2, 2a, 2b and normal cyclic prefix

 

- For PUCCH format 2 and extended cyclic prefix

 

- For PUCCH format 3 or for all slot/subslot PUCCH formats except slot/subslot PUCCH format 4 and when UE transmits HARQ-ACK/SR without periodic CSI,

- If the UE is configured by higher layers to transmit PUCCH format 3 on two antenna ports, or if the UE transmits more than 11 bits of HARQ-ACK/SR

 

- Otherwise

 

- For PUCCH format 3 and when UE transmits HARQ-ACK/SR and periodic CSI,

- If the UE is configured by higher layers to transmit PUCCH format 3 on two antenna ports, or if the UE transmits more than 11 bits of HARQ-ACK/SR and CSI

 

- Otherwise

 

- For PUCCH format 4,  is the bandwidth of the PUCCH format 4 expressed in number of resource blocks valid for subframe/slot/subslot *i* and serving cell. For PUCCH format 5, .

-  where , and

- for subframe-PUCCH

-  is the number of HARQ-ACK/SR/RI/CQI/PMI bits including CRC bits transmitted on PUCCH format 4/5 in subframe *i*;

-  for PUCCH format 4 and  for PUCCH format 5;

-  if shortened PUCCH format 4 or shortened PUCCH format 5 is used in subframe *i* and  otherwise.

* for slot/subslot-PUCCH

-  is the total number of HARQ-ACK/SR bits including CRC bits transmitted on PUCCH format 4 in slot/subslot *i*;

-  is the number of REs used for slot/subslot-PUCCH format 4 transmission in slot/subslot *i*

-  is a parameter composed of the sum of a parameter  provided by higher layers and a parameter  provided by higher layers.

-  is a UE specific correction value, also referred to as a TPC command, included in a PDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D for the primary cell, or included in a MPDCCH with DCI format 6-1A, or included in an EPDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D for the primary cell, or included in a PDCCH/SPDCCH with DCI format 7-1A/1B/1C/1D/1E/1F/1G if the UE is configured with higher layer parameter *shortTTI* for the primary cell, or sent jointly coded with other UE specific PUCCH correction values on a PDCCH/MPDCCH with DCI format 3/3A whose CRC parity bits are scrambled with TPC-PUCCH-RNTI.

- For a non-BL/CE UE, if the UE is not configured for EPDCCH monitoring, the UE attempts to decode

- a PDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI and one or several PDCCHs of DCI format 1A/1B/1D/1/2A/2/2B/2C/2D with the UE's C-RNTI or SPS C-RNTI on every subframe except when in DRX.

- a PDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI in case of slot/subslot-PUCCH transmissions associated with PDSCH/PUSCH transmissions without a corresponding PDCCH/SPDCCH, when configured by higher layer *parameter tpc-PDCCH-ConfigPUCCH-SPS*

- a PDCCH/SPDCCH of DCI format 7-1A/1B/1C/1D/1E/1F/1G if the UE is configured with higher layer parameter *shortTTI* in case of slot/subslot-PUCCH transmissions associated with PDSCH/PUSCH transmissions with corresponding PDCCH/SPDCCH

- If a UE is configured for EPDCCH monitoring, the UE attempts to decode

- a PDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI and one or several PDCCHs of DCI format 1A/1B/1D/1/2A/2/2B/2C/2D with the UE's C-RNTI or SPS C-RNTI as described in Subclause 9.1.1, and

- one or several EPDCCHs of DCI format 1A/1B/1D/1/2A/2/2B/2C/2D with the UE's C-RNTI or SPS C-RNTI, as described in Subclause 9.1.4, and

- a PDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI in case of slot/subslot-PUCCH transmissions associated with PDSCH/PUSCH transmissions without a corresponding PDCCH/SPDCCH, when configured by higher layer *parameter tpc-PDCCH-ConfigPUCCH-SPS*

- a PDCCH/SPDCCH of DCI format 7-1A/1B/1C/1D/1E/1F/1G with the UE's C-RNTI as described in Subclause 9.6.1if the UE is configured with higher layer parameter *shortTTI* in case of slot/subslot-PUCCH transmissions associated with PDSCH/PUSCH transmissions with corresponding PDCCH/SPDCCH.

- For a BL/CE UE configured with CEModeA, the UE attempts to decode a MPDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI and MPDCCH of DCI format 6-1A with the UE's C-RNTI or SPS C-RNTI or PUR-RNTI on every BL/CE downlink subframe except when in DRX.

- If the UE decodes

- a PDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D/7-1A/1B/1C/1D/1E/1F/1G or

- an EPDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D or

- an MPDCCH with DCI format 6-1A or

- a SPDCCH with DCI format 7-1A/1B/1C/1D/1E/1F/1G

 for the primary cell and the corresponding detected RNTI equals the C-RNTI or SPS C-RNTI or PUR-RNTI of the UE and the TPC field in the DCI format is not used to determine the PUCCH resource as in Subclause 10.1, the UE shall use the  provided in that PDCCH/EPDCCH/MPDCCH/SPDCCH.

 Else

- if the UE decodes a PDCCH/MPDCCH with DCI format 3/3A, the UE shall use the  provided in that PDCCH/MPDCCH

 else the UE shall set  = 0 dB.

<Unchanged parts are omitted>

## 7.1 UE procedure for receiving the physical downlink shared channel

Except the subframes indicated by the higher layer parameter *mbsfn-SubframeConfigList* or by *mbsfn-SubframeConfigList-v1250* or by *mbsfn-SubframeConfigList-v14xy* or by *laa-SCellSubframeConfig* of serving cell , a UE shall

<Unchanged parts are omitted>

For BL/CE UEs, the set of BL/CE DL subframes is indicated as follows

- If DL resource reservation is enabled for the UE as specified in [11],

- for PDSCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space including PDSCH transmission without a corresponding MPDCCH,

- if the Resource reservation field in the DCI is set to 0, then the set of BL/CE DL subframes corresponds to all downlink subframes and special subframes during the PDSCH transmission;

- if the Resource reservation field in the DCI is set to 1, then the set of BL/CE DL subframes corresponds to all downlink subframes and special subframes that are not fully reserved according to higher layer parameters (a subframe is considered fully reserved if and only if all OFDM symbols of all PRBs of the PDSCH transmission are reserved in the subframe);

- for MPDCCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space,

- the set of BL/CE DL subframes corresponds to all downlink subframes and available special subframes that are not fully reserved according to higher layer parameters (a subframe is considered fully reserved if and only if all OFDM symbols of all PRBs of the MPDCCH transmission are reserved in the subframe).

- In all other cases, the set of BL/CE DL subframes is indicated by the higher layers according to *fdd-DownlinkOrTddSubframeBitmapBR* [11].

A BL/CE UE shall upon detection of a MPDCCH with DCI format 6-1A, 6-1B, 6-2 intended for the UE, decode the corresponding PDSCH in one more BL/CE DL subframes as described in Subclause 7.1.11, with the restriction of the number of transport blocks defined in the higher layers.

<Unchanged parts are omitted>

If a BL/CE UE is configured by higher layers to decode MPDCCH with CRC scrambled by the PUR-RNTI, the UE shall decode the MPDCCH and any corresponding PDSCH according to the respective combinations defined in Table 7.1-9. The scrambling initialization of PDSCH corresponding to these MPDCCHs is by PUR-RNTI.

Table 7.1-9: MPDCCH and PDSCH configured by PUR-RNTI

|  |  |  |  |
| --- | --- | --- | --- |
| Transmission mode | DCI format | Search Space | Transmission scheme of PDSCH corresponding to MPDCCH |
| **Mode 1** | 6-1A or 6-1B | UE specific by PUR-RNTI | Single-antenna port, port 0 (see Subclause 7.1.1) |
| **Mode 2** | 6-1A or 6-1B | UE specific by PUR-RNTI | Transmit diversity (see Subclause 7.1.2) |
| **Mode 6** | 6-1A | UE specific by PUR-RNTI | Closed-loop spatial multiplexing (see Subclause 7.1.4) using a single transmission layer |
| **Mode 9** | 6-1A | UE specific by PUR-RNTI | Single-antenna port, port 7 or 8 (see Subclause 7.1.1) |
| 6-1B | UE specific by PUR-RNTI | Single-antenna port, port 7 (see Subclause 7.1.1) |

<Unchanged parts are omitted>

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

The term "UL/DL configuration" in this Subclause refers to the higher layer parameter *subframeAssignment* unless specified otherwise.

<Unchanged parts are omitted>

For BL/CE UEs, the set of BL/CE UL subframes is indicated as follows

- If UL resource reservation is enabled for the UE as specified in [11],

- for PUSCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space including PUSCH transmission without a corresponding MPDCCH,

- if the Resource reservation field in the DCI is set to 0, then the set of BL/CE UL subframes corresponds to all uplink subframes during the PUSCH transmission;

- if the Resource reservation field in the DCI is set to 1, then the set of BL/CE UL subframes corresponds to all uplink subframes that are not fully reserved according to higher layer parameters (a subframe is considered fully reserved if and only if all SC-FDMA symbols of the PUSCH transmission are reserved in the subframe);

- for PUCCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space including PUSCH transmission without a corresponding MPDCCH,

- the set of BL/CE UL subframes corresponds to all uplink subframes that are not fully reserved according to higher layer parameters (a subframe is considered fully reserved if and only if all SC-FDMA symbols of the PUCCH transmission are reserved in the subframe).

- In all other cases, the set of BL/CE UL subframes is indicated by the higher layers according to *fdd-DownlinkOrTddSubframeBitmapBR* and *fdd-UplinkSubframeBitmapBR* [11].

For BL/CE UEs, PUSCH transmission can be scheduled by a MPDCCH with DCI format 6-0A/6-0B, 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 MPDCCH with DCI format 6-0A/6-0B.

<Unchanged parts are omitted>

A UE may transmit PUSCH on preconfigured uplink resources as configured by higher layers. The scrambling initialization of PUSCH transmission using preconfigured uplink resource is by PUR-RNTI.

If a UE is configured by higher layers to decode MPDCCHs with the CRC scrambled by the PUR-RNTI, the UE shall decode the MPDCCH according to the combination defined in Table 8-10 and in case the indication in the DCI corresponds to the retransmission of a transport block transmitted using preconfigured uplink resource, transmit a corresponding PUSCH. The scrambling initialization of this PUSCH corresponding to these MPDCCHs and the PUSCH retransmission for the same transport block is by PUR-RNTI.

Table 8-10: MPDCCH and PUSCH configured by PUR-RNTI

|  |  |  |  |
| --- | --- | --- | --- |
| Transmission mode | DCI format | Search Space | Transmission scheme of PUSCH corresponding to MPDCCH |
| Mode 1 | DCI format 6-0A or 6-0B | UE specific by PUR-RNTI | Single-antenna port, port 10 (see Subclause 8.0.1) |

<Unchanged parts are omitted>

### 9.1.5 MPDCCH assignment procedure

A BL/CE UE shall monitor a set of MPDCCH candidates on one or more Narrowbands (described in Subclause 6.2.7 of [3]) as configured by higher layer signalling for control information, where monitoring implies attempting to decode each of the MPDCCHs in the set according to all the monitored DCI formats. The Narrowband in a subframe used for MPDCCH monitoring is determined as described in [3].

A UE that is not a BL/CE UE is not required to monitor MPDCCH.

A BL/CE UE can derive the configuration of one or two MPDCCH-PRB-sets for MPDCCH monitoring from higher layer signalling. The PRB-pairs corresponding to MPDCCH-PRB-set  are indicated by higher layers. Each MPDCCH-PRB-set consists of set of ECCEs numbered from 0 to where is the number of ECCEs in MPDCCH-PRB-set  of subframe .

The MPDCCH-PRB-set(s) can be configured by higher layers for either localized MPDCCH transmission or distributed MPDCCH transmission.

The set of MPDCCH candidates to monitor are defined in terms of MPDCCH search spaces.

The BL/CE UE shall monitor one or more of the following search spaces

- a Type0-MPDCCH common search space if configured with CEmodeA, or if configured with CEmodeB and higher layer parameter *ce-ETWS-CMAS-RxInConn,*

- a Type1-MPDCCH common search space,

- a Type1A-MPDCCH common search space,

- a Type2-MPDCCH common search space,

- a Type2A-MPDCCH common search space, and

- a MPDCCH UE-specific search space.

A BL/CE UE configured with CEModeB is not required to monitor Type0-MPDCCH common search space unless the UE is configured with higher layer parameter *ce-ETWS-CMAS-RxInConn*.

The BL/CE UE is not required to simultaneously monitor MPDCCH UE-specific search space and Type1-MPDCCH common search space.

The BL/CE UE is not required to simultaneously monitor MPDCCH UE-specific search space and Type2-MPDCCH common search space.

The BL/CE UE is not required to monitor Type1A-MPDCCH common search space or Type2A-MPDCCH common search space if the set of subframes comprising the search space include any subframes in which it monitors Type1-MPDCCH common search space or any subframes in which the UE receives PDSCH assigned by PDCCH with DCI CRC scrambled by P-RNTI.

The BL/CE UE is not required to monitor Type2A-MPDCCH common search space if the set of subframes comprising the search space include any subframes in which it monitors Type1A-MPDCCH common search space or any subframes in which the UE receives PDSCH assigned by MPDCCH with DCI CRC scrambled by SC-RNTI.

A BL/CE UE is not required to monitor Type1-MPDCCH common search space or in case of half-duplex FDD operation MWUS if the set of subframes comprising the search space or the set of subframes where MWUS may be received include any subframes in which the UE has initiated a PUSCH transmission using preconfigured uplink resource on a given serving cell.

A BL/CE UE is not required to monitor Type1-MPDCCH common search space or MWUS in subframes in which the UE monitors a UE-specific MPDCCH search space given by PUR-RNTI.

A BL/CE UE is not expected to monitor an MPDCCH candidate, if an ECCE corresponding to that MPDCCH candidate is mapped to a PRB pair that overlaps with a transmission of PDSCH scheduled previously in the same subframe.

For aggregation level  or  ECCEs, the number of ECCEs refers to the MPDCCH mapping to the REs of the 2+4 PRB set as defined in [3]. An MPDCCH search space at aggregation level  and repetition level is defined by a set of MPDCCH candidates where each candidate is repeated in a set of  consecutive BL/CE downlink subframes starting with subframe . For an MPDCCH-PRB-set , the ECCEs corresponding to MPDCCH candidate *m* of the search space  are given by



where



,

is the number of MPDCCH candidates to monitor at aggregation level in MPDCCH-PRB-set  in each subframe in the set of  consecutive subframes.

for MPDCCH UE-specific search space is determined as described in Subclause 9.1.4, and for Type0-MPDCCH common search space, Type1-MPDCCH common search space and Type2-MPDCCH common search space.

For , if subframe is a special subframe that does not support MPDCCH according to table 6.8B.1-1 in [3], the UE shall calculate  by assuming for normal cyclic prefix and for extended cyclic prefix.

A BL/CE UE is not expected to monitor MPDCCH in subframes that are not BL/CE DL subframes as defined in clause 7.1.

Until BL/CE UE receives higher layer configuration of MPDCCH UE-specific search space, the BL/CE UE monitors MPDCCH according to the same configuration of MPDCCH search space and Narrowband as that for MPDCCH scheduling Msg4.

The aggregation and repetition levels defining the MPDCCH search spaces and the number of monitored MPDCCH candidates are given as follows:

For MPDCCH UE-specific search space

- if the BL/CE UE is configured with =2 or =4 PRB-pairs, and *mPDCCH-NumRepetition*=1, and

- if the MPDCCH-PRB-set is configured for distributed transmission, the aggregation levels defining the search spaces and the number of monitored MPDCCH candidates are listed in Table 9.1.4-1a and Table 9.1.4-1b, where  is substituted with  for ≤24, and  is substituted with .

- if the MPDCCH-PRB-set is configured for localized transmission, the aggregation levels defining the search spaces and the number of monitored MPDCCH candidates are listed in Table 9.1.4-2a and Table 9.1.4-2b, where  is substituted with  and  is substituted with .

- otherwise

- if the UE is configured with CEModeA, and =2 or =4, the aggregation and repetition levels defining the search spaces and the number of monitored MPDCCH candidates are listed in Table 9.1.5-1a

- if the UE is configured with CEModeA, and =2+4 , the aggregation and repetition levels defining the search spaces and the number of monitored MPDCCH candidates are listed in Table 9.1.5-1b

- if the UE is configured with CEModeB, and =2 or =4, the aggregation and repetition levels defining the search spaces and the number of monitored MPDCCH candidates are listed in Table 9.1.5-2a

- if the UE is configured with CEModeB, and =2+4 , the aggregation and repetition levels defining the search spaces and the number of monitored MPDCCH candidates are listed in Table 9.1.5-2b

is the number of PRB-pairs configured for MPDCCH UE-specific search space. When =2+4, it is given by the higher layer parameter *numberPRB-Pairs-r13,* and when =2 or =4, it is given by the higher layer parameter *numberPRB-Pairs-r11*, except for MPDCCH candidates associated with PUR-RNTI in which case it is given by the higher layer parameter *mpdcch-PRB-Pairs-r16* in *PUR-Config*.

, , ,  are determined from Table 9.1.5-3 by substituting the value of  with the value of higher layer parameter *mPDCCH-NumRepetition*, except for MPDCCH candidates associated with PUR-RNTI in which case it is given by the value of the higher layer parameter *mpdcch-NumRepetition-r16* in *PUR-Config*.

<Unchanged parts are omitted>

For MPDCCH UE-specific search space given by PUR-RNTI, distributed MPDCCH transmission is used.

For MPDCCH UE-specific search space, Type0-MPDCCH common search space, Type1A-MPDCCH common search space, Type2-MPDCCH common search space and Type2A-MPDCCH common search space locations of starting subframe  are given by where is the th consecutive BL/CE DL subframe from subframe , and , and , and , where

- subframe  is a subframe satisfying the condition , where 

- For MPDCCH UE-specific search space and Type0-MPDCCH common search space,  is given by the higher layer parameter *mPDCCH-startSF-UESS,* except for MPDCCH candidates associated with PUR-RNTI in which case it is given by the higher layer parameter *mpdcch-startSF-UESS-r16* in *PUR-Config*,

- For Type1A-MPDCCH common search space,  is given by the higher layer parameter *mpdcch-startSF-SC-MCCH*

- For Type2-MPDCCH common search space,  is given by the higher layer parameter *mPDCCH-startSF-CSS-RA-r13*

- For Type2A-MPDCCH common search space,  is given by the higher layer parameter *mpdcch-startSF-SC-MTCH*

- is given by the higher layer parameter *mpdcch-Offset-SC-MTCH* for Type2A-MPDCCH common search space, and by the higher layer parameter *mpdcch-Offset-PUR-SS-r16* in *PUR-Config* for MPDCCH candidates associated with PUR-RNTI, and otherwise; and

- is given by the higher layer parameter *mPDCCH-NumRepetition* for MPDCCH UE-specific search space and Type0-MPDCCH common search space, except for MPDCCH candidates associated with PUR-RNTI in which case it is given by the higher layer parameter *mpdcch-NumRepetition-r16* in *PUR-Config*, and *mPDCCH-NumRepetition-RA* for Type2-MPDCCH common search space, and *mpdcch-NumRepetitions-SC-MCCH* for Type1A-MPDCCH common search space, and *mpdcch-NumRepetitions-SC-MTCH* for Type2A-MPDCCH common search space and

- , , , are given in Table 9.1.5-3.

A BL/CE UE is not expected to be configured with values of and that result in non-integer values of .

For Type1-MPDCCH common search space, = and is determined from locations of paging opportunity subframes,

If *SystemInformationBlockType1-BR* or SI message is transmitted in one narrowband in subframe , a BL/CE UE shall assume MPDCCH in the same narrowband in the subframe  is dropped.

The BL/CE UE is not required to monitor an MPDCCH search space if any ECCEs corresponding to any of its MPDCCH candidates occur within a frame before and also occur within frame.

The BL/CE UE is not required to monitor an MPDCCH search space during the PUSCH transmission gap as defined in clause 5.3.4 of [3].

The BL/CE UE is not expected to be configured with overlapping MPDCCH search spaces of the same type.

A BL/CE UE configured to monitor MPDCCH candidates with CRC scrambled by C-RNTI or SPS C-RNTI with the same payload size and with the same aggregation level in the Type0-MPDCCH common search space and the MPDCCH UE-specific search space shall assume that for the MPDCCH candidates with CRC scrambled by C-RNTI or SPS C-RNTI, only the MPDCCH in the UE specific search space is transmitted.

For MPDCCH UE-specific search space or for Type0-MPDCCH common search space if the higher layer parameter *mPDCCH-NumRepetition* is set to 1 or the higher layer parameter *mpdcch-NumRepetition* in *PUR-MPDCCH-Config* is set to 1; or for Type2-MPDCCH common search space if the higher layer parameter *mPDCCH-NumRepetition-RA* is set to 1; or for Type2A-MPDCCH common search space if the higher layer parameter *mpdcch-NumRepetitions-SC-MTCH* is set to 1;

- The BL/CE UE is not required to monitor MPDCCH

- For TDD and normal downlink CP, in special subframes for the special subframe configurations 0 and 5 shown in Table 4.2-1 of [3], or for the special subframe configuration 10 configured by the higher layer signalling *ssp10-CRS-LessDwPTS*

- For TDD and extended downlink CP, in special subframes for the special subframe configurations 0, 4 and 7 shown in Table 4.2-1 of [3];

otherwise

- The BL/CE UE is not required to monitor MPDCCH

- For TDD, in special subframes, if the BL/CE UE is configured with CEModeB

- For TDD and normal downlink CP, in special subframes for the special subframe configurations 0, 1, 2, 5, 6, 7, 9, and 10 shown in Table 4.2-1 of [3], if the BL/CE UE is configured with CEModeA

- For TDD and extended downlink CP, in special subframes for the special subframe configurations 0, 4 and 7 shown in Table 4.2-1 of [3], if the BL/CE UE is configured with CEModeA.

- For TDD, in special subframes, for MPDCCH in Type1/1A-MPDCCH common search space.

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* with duration given by higher layer parameter *pur-MPDCCH-SS-window-duration*. 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.

The number of MPDCCH repetitions is indicated in the 'DCI subframe repetition number' field in the DCI according to the mapping in Table 9.1.5-5. For a BL/CE UE in half-duplex FDD operation, if the UE is configured with CEModeA, and configured with higher layer parameter *ce-HARQ-AckBundling*, and 'HARQ-ACK bundling flag' in the corresponding DCI is set to 1, the UE shall assume the number of MPDCCH repetitions as 1.

Table 9.1.5-5: Mapping for DCI subframe repetition number

|  |  |
| --- | --- |
| R | DCI subframe repetition number |
|
|  | 00 |
|  | 01 |
|  | 10 |
|  | 11 |

<Unchanged parts are omitted>

#### 9.1.5.3 Preconfigured Uplink Resource ACK/fallback procedure

If a UE has initiated a PUSCH transmission using preconfigured uplink resource on a given serving cell, and upon detection of a MPDCCH with DCI format 6-0A/6-0B with CRC scrambled by PUR-RNTI intended for the UE within the PUR search space window as defined in Subclause 9.1.5, and the corresponding DCI is for PUR ACK/fallback indication (as defined in [4]),

- the UE shall deliver the PUR ACK/fallback indication, as signalled on the MPDCCH, to the higher layers, and

- the UE shall deliver to higher layers a 3-bit PUSCH repetition adjustment according to Table 8-2b for CEModeA or Table 8-2c for CEModeB as signalled on the MPDCCH, where a bit with a value of 0 shall be prepended to the DCI field if the DCI field has a size of 2 bits.

<Unchanged parts are omitted>

## 7.3 UE procedure for reporting HARQ-ACK

If the UE is not configured with *shortTTI*, the term 'subframe/slot' refers to a subframe in this subclause.

<Unchanged parts are omitted>

For a BL/CE UE, if the UE is configured with CEModeA, and if the UE is configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI format 6-1A with CRC scrambled by C-RNTI,

- for HARQ-ACK transmission associated with the corresponding DCI, the UE shall generate *M* HARQ-ACK bits by performing a logical AND operation of HARQ-ACKs across all TBs in each TB bundle where *b* = 1, …, *M*;

- the set of TBs that belong to TB bundle and the number of TB bundles *M* are given by Table 7.3-1;

- the value of is the number of scheduled TB determined in the corresponding DCI.

<Unchanged parts are omitted>

## 10.2 Uplink HARQ-ACK timing

For TDD or for FDD-TDD and primary cell frame structure type 2 or for FDD-TDD and primary cell frame structure type 1, if a UE configured with *EIMTA-MainConfigServCell-r12* for a serving cell, "UL/DL configuration" of the serving cell in Subclause 10.2 refers to the UL/DL configuration given by the parameter *eimta-HARQ-ReferenceConfig-r12* for the serving cell unless specified otherwise.

<Unchanged parts are omitted>

For FDD, if a BL/CE UE is configured with CEModeA, and if the UE is not configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which an HARQ-ACK shall be provided, transmit the HARQ-ACK response using the same  derived according to Subclause 10.1.2.1 in subframe(s) with , *i =0,1, …, N-1*, where

- is the number of scheduled TB determined in the corresponding DCI;

- if the UE is not configured with higher layer parameter *interleaving* in *ce-PDSCH-MultiTB-Config* and the UE is not in half-duplex FDD operation

- ,

- otherwise

- **,**

- is the last subframe in which the PDSCH containing TB is transmitted;

- subframe is the last subframe in which the PDSCH is transmitted;

- denotes the number of consecutive subframes including non-BL/CE subframes where the PUCCH with HARQ ACK for TB with repetition number of *N* is transmitted;

and

*- 0≤k0<k1<…,kN-1* and the value of and  is provided by higher layer parameter *pucch-NumRepetitionCE-format1,* if configured, otherwise it is provided by higher layer parameter *pucch-NumRepetitionCE*-*Msg4-Level0-r13, pucch-NumRepetitionCE-Msg4-Level1-r13, pucch-NumRepetitionCE-Msg4-Level2-r13* or *pucch-NumRepetitionCE-Msg4-Level3-r13* depending on whether the most recent PRACH coverage enhancement level for the UE is 0, 1, 2 or 3, respectively; and

 if *N>1*

- subframe(s) with *i=0,1,…,N-1* for TB are *N* consecutive BL/CE UL subframe(s) immediately after subframe , and the set of BL/CE UL subframes are configured by higher layers;

 otherwise

- k0 =0

For FDD, if a BL/CE UE is configured with CEModeA, and if the UE is configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which an HARQ-ACK shall be provided, transmit the HARQ-ACK response using the same  derived according to Subclause 10.1.2.1 in subframe(s) with , *i =0,1, …, N-1*, where

- is the number of scheduled TB determined in the corresponding DCI;

-  is the multi-TB HARQ-ACK bundling size;

- if the UE is not configured with higher layer parameter *interleaving* in *ce-PDSCH-MultiTB-Config* and the UE is not in half-duplex FDD operation

- ,

- otherwise

- subframe **,**

- subframe is the last subframe in which the PDSCH containing TB bundle is transmitted;

- subframe is the last subframe in which the PDSCH is transmitted;

- denotes the number of consecutive subframes including non-BL/CE subframes where the PUCCH with HARQ ACK for TB bundle with repetition number of *N* is transmitted;

and

*- 0≤k0<k1<…,kN-1* and the value of and  is provided by higher layer parameter *pucch-NumRepetitionCE-format1,* if configured, otherwise it is provided by higher layer parameter *pucch-NumRepetitionCE*-*Msg4-Level0-r13, pucch-NumRepetitionCE-Msg4-Level1-r13, pucch-NumRepetitionCE-Msg4-Level2-r13* or *pucch-NumRepetitionCE-Msg4-Level3-r13* depending on whether the most recent PRACH coverage enhancement level for the UE is 0, 1, 2 or 3, respectively; and

 if *N>1*

- subframe(s) with *i=0,1,…,N-1* for TB bundle are *N* consecutive BL/CE UL subframe(s) immediately after subframe, and the set of BL/CE UL subframes are configured by higher layers;

 otherwise

- k0 =0

For TDD, a BL/CE UE shall upon detection of a PDSCH within subframe(s) , where  and  is defined in Table 10.1.3.1-1 intended for the UE and for which HARQ-ACK response shall be provided, transmit the HARQ-ACK response using the same  derived according to Subclause 10.1.3.1 in subframe(s) *n+ki* with *i =0,1, …, N-1*, where

- subframe *n-k* is the last subframe in which the PDSCH is transmitted; and

*- 0≤k0<k1<…,kN-1* and the value of and  is provided by higher layers parameter *pucch-NumRepetitionCE-format1,* if configured, otherwise it is provided by higher layer parameter *pucch-NumRepetitionCE*-*Msg4-Level0-r13, pucch-NumRepetitionCE-Msg4-Level1-r13, pucch-NumRepetitionCE-Msg4-Level2-r13* or *pucch-NumRepetitionCE-Msg4-Level3-r13* depending on whether the most recent PRACH coverage enhancement level for the UE is 0, 1, 2 or 3, respectively; and

if *N>1*

- subframe(s) *n+ki* with *i=0,1,…,N-1* are *N* consecutive BL/CE UL subframe(s) immediately after subframe *n-1*, and the set of BL/CE UL subframes are configured by higher layers;

 otherwise

- k0 =0

except if the UE is configured with higher layer parameter *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI.

For TDD, if a BL/CE UE is configured with higher layer parameter *ce-PDSCH-MultiTB-Config* and multiple TBs are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which HARQ-ACK response shall be provided, transmit the HARQ-ACK response using the same  derived according to Subclause 10.1.3.1 in subframe(s) *+ki* with , *i =0,1, …, N-1*, where

- is the number of TB bundles

- if the UE is not configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config,* with bundle consisting of only *.*

- Else, the value of and the corresponding TBs in each bundle is determined according to subclause 7.3

- is the number of scheduled TB determined in the corresponding DCI;

- ,

- is the last subframe in which the PDSCH containing TB bundle is transmitted;

- denotes the number of consecutive subframes including subframes that are not BL/CE UL subframes where the PUCCH with HARQ ACK for TB bundle with repetition number of *N* is transmitted;

and

*- 0≤k0<k1<…,kN-1* and the value of and  is provided by higher layers parameter *pucch-NumRepetitionCE-format1,* if configured, otherwise it is provided by higher layer parameter *pucch-NumRepetitionCE*-*Msg4-Level0-r13, pucch-NumRepetitionCE-Msg4-Level1-r13, pucch-NumRepetitionCE-Msg4-Level2-r13* or *pucch-NumRepetitionCE-Msg4-Level3-r13* depending on whether the most recent PRACH coverage enhancement level for the UE is 0, 1, 2 or 3, respectively; and

- subframe(s) with *i=0,1,…,N-1* for TB bundle are *N* consecutive BL/CE UL subframe(s) immediately after subframe , and the set of BL/CE UL subframes are configured by higher layers.

The uplink timing for the ACK corresponding to a detected PDCCH/EPDCCH indicating downlink SPS release shall be the same as the uplink timing for the HARQ-ACK corresponding to a detected PDSCH, as defined above.

<Unchanged parts are omitted>