**3GPP TSG-RAN WG2 Meeting #109bis-e *R2-200xxxx***

**Online, 20 – 30 April 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.822** | **CR** | **-** | **rev** | - | **Current version:** | **15.0.1** |  |
|  | | | | | | | | |
| *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:*** | UE feature list introduction for NR IIOT WI | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IIOT | | | | |  | ***Date:*** | | | 2020-04 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **Cat B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Due to NR IIOT WI finalization, UE features list agreed as part of NR IIOT WI has to be specified. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | CR captures UE features list agreed as part of NR IIOT WI.  Updates after RAN2#109-e meeting:   * Removed mention of EHC profiles in the EHC capability description * Removed EHC padding addition capability * EHC context continuation operation capability was added * Resolved editor’s notes were removed * New editor’s notes were added to capture new open points from RAN2#109-e meeting   Updates after RAN2#109bis-e meeting:   * Editorial corrections * Removed obsolete editor’s notes and added new ones. | | | | | | | | |
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| ***Consequences if not approved:*** | | UE features related to NR IIOT WI are unspecified. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.1, 4.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## 4.1 Layer-1 UE features

Table 4.1-1 provides the list of Layer-1 features, as shown in [3] and the corresponding UE capability field name, as specified in TS 38.331 [2].

Table 4.1-1: Layer-1 feature list

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Field name in TS 38.331 [2] | Parent IE in TS 38.331 [2] | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Note | Mandatory/Optional |
| 5. Scheduling/HARQ operation | 5-1 | Basic scheduling/HARQ operation | 1) Frequency-domain resource allocation  - RA Type 0 only and Type 1 only for PDSCH without interleaving  - RA Type 1 for PUSCH without interleaving  2) Time-domain resource allocation  - 1-14 OFDM symbols for PUSCH once per slot  - One unicast PDSCH per slot  - Starting symbol, and duration are determined by using the DCI  - PDSCH mapping type A with 7-14 OFDM symbols  - PUSCH mapping type A and type B  - For type 1 CSS without dedicated RRC configuration and for type 0, 0A, and 2 CSS, PDSCH mapping type A with {4-14} OFDM symbols and type B with {2, 4, 7} OFDM symbols  3) TBS determination  4) Nominal UE processing time for N1 and N2 (Capability #1)  5) HARQ process operation with configurable number of DL HARQ processes of up to 16  6) Cell specific RRC configured UL/DL assignment for TDD  7) Dynamic UL/DL determination based on L1 scheduling DCI with/without cell specific RRC configured UL/DL assignment  8) Intra-slot frequency-hopping for PUSCH scheduled by Type 1 CSS before RRC connection  9) In TDD support at most one switch point per slot for actual DL/UL transmission(s)  10) DL scheduling slot offset K0=0  11) DL scheduling slot offset K0=1 for type 1 CSS without dedicated RRC configuration and for type 0, 0A, and 2 CSS  12) UL scheduling slot offset K2<=12  For type 1 CSS without dedicated RRC configuration and for type 0, 0A, and 2 CSS, interleaving for VRB-to-PRB mapping for PDSCH |  | n/a | n/a | n/a | n/a |  | Mandatory without capability signalling |
| 5-1a | UE specific RRC configure UL/DL assignment | Dynamic UL/DL determination based on L1 scheduling DCI with cell-specific and UE specific RRC configured UL/DL assignment |  | *ue-SpecificUL-DL-Assignment* | *FeatureSetDownlink* | n/a | n/a |  | Optional with capability signalling |
| 5-1b | More than one DL/UL switch point in a slot | In TDD support more than one switch points in a slot for actual DL/UL transmission(s) |  | *tdd-MultiDL-UL-SwitchPerSlot* | *Phy-ParametersFRX-Diff* | TDD only | Yes |  | Optional with capability signalling |
| 5-2 | RA Type 0 for PUSCH | RA Type 0 for PUSCH |  | *ra-Type0-PUSCH* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-3 | Dynamic switching between RA Type 0 and RA Type 1 for PDSCH | Dynamic switching between RA Type 0 and RA Type 1 for PDSCH |  | *dynamicSwitchRA-Type0-1-PDSCH* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-4 | Dynamic switching between RA Type 0 and RA Type 1 for PUSCH | Dynamic switching between RA Type 0 and RA Type 1 for PUSCH | 5-2 | *dynamicSwitchRA-Type0-1-PUSCH* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-5a | UE PDSCH processing capability #2 | UE can report values 'X' and 'Fallback', and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X DL CCs, the UE may expect to be scheduled with up to 1 PDSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled, otherwise  - If Fallback = 'SC', UE supports Capability #2 processing time on lowest cell index among the configured carriers in the band where the value is reported  - If Fallback = 'Cap1-only', UE supports only Capability #1, in the band where the value is reported  2) No scheduling limitation  3) N1 based on Table 5.3-2 of TS 38.214 for given SCS from {15, 30, 60} kHz |  | *pdsch-ProcessingType2* | *FeatureSetDownlink-v1540* | n/a | Applicable to FR1 only | This capability is necessary for each SCS (15kHz, 30kHz, 60kHz)  More than one set of per SCS per band reports can be signaled for a given band combination | Optional with capability signaling  Candidate values for Component 1:  X in {1, ..., 16},  Fallback {'SC','Cap1-only'} |
| 5-5b | UE PDSCH processing capability #2 with scheduling limitation for 30kHz-SCS | Capability #2 supported only if 1 carrier configured in the band (independent of #carriers configured in other bands)  2) Max PDSCH BW of 136 PRBs on the configured serving cell which processingType2Enabled is configured and set to enabled  3) N1 based on Table 5.3-2 of TS 38.214 for 30 kHz SCS  4) UE reports the number of unicast PDSCH per slot for different TBs |  | *pdsch-ProcessingType2-Limited* | *FeatureSetDownlink-v1540* | n/a | Applicable to FR1 only | This capability is applicable to 30kHz-SCS only | Optional with capability signaling  Component 4) the value ranges {1, 2, 4, 7} |
| 5-5c | UE PUSCH processing capability #2 | UE can report values 'X' and 'Fallback', and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X UL CCs, the UE may expect to be scheduled with up to 1 PUSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled, otherwise  - If Fallback = 'SC', UE supports Capability #2 processing time on lowest cell index among the configured carriers in the band where the value is reported  - If Fallback = 'Cap1-only', UE supports only Capability #1, in the band where the value is reported  2) N2 based on Table 6.4-2 of TS 38.214 for given SCS from {15, 30, 60} kHz |  | *pusch-ProcessingType2* | *FeatureSetUplink-v1540* | n/a | Applicable to FR1 only | This capability is necessary for each SCS (15kHz, 30kHz, 60kHz)  More than one set of per SCS per band reports can be signaled for a given band combination | Optional with capability signaling  Candidate values for Component 1:  X in {1, …, 16},  Fallback {'SC','Cap1-only'} |
| 5-6 | PDSCH mapping type A with less than 7 OFDM symbols | or type 1 CSS with dedicated RRC configuration, for type 3 CSS and UE-SS, PDSCH mapping type A with less than 7 OFDM symbols |  | *pdsch-MappingTypeA* | *Phy-ParametersCommon* | No | No |  | Mandatory with capability signalling which shall be set to '1' |
| 5-6a | PDSCH mapping type B | PDSCH mapping type B |  | *pdsch-MappingTypeB* | *Phy-ParametersCommon* | No | No |  | Mandatory with capability signalling |
| 5-7 | Interleaving for VRB-to-PRB mapping for PDSCH | Interleaving for VRB-to-PRB mapping for PDSCH |  | *interleavingVRB-ToPRB-PDSCH* | *Phy-ParametersCommon* | No | No |  | Mandatory with capability signalling |
| 5-9 | Intra-slot frequency-hopping for PUSCH except for PUSCH scheduled by Type 1 CSS before RRC connection | Intra-slot frequency-hopping for PUSCH except for PUSCH scheduled by Type 1 CSS before RRC connection |  | *intraSlotFreqHopping-PUSCH* | *Phy-ParametersFRX-Diff* | No | Yes |  | Mandatory with capability signalling |
| 5-10 | Inter-slot frequency hopping for PUSCH | Inter-slot frequency hopping for PUSCH |  | *interSlotFreqHopping-PUSCH* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-11 | Up to 2 unicast PDSCHs per slot per CC for different TBs for UE processing time Capability 1 | Up to 2 unicast PDSCHs per slot per CC only in TDM is supported for Capability 1  1) PDSCH(s) for Msg. 4 is included |  | *pdsch-ProcessingType1-DifferentTB-PerSlot* | *FeatureSetDownlink* | n/a | n/a | This capability is necessary for each SCS. | Optional with capability signalling |
| 5-11a | Up to 7 unicast PDSCHs per slot per CC for different TBs for UE processing time Capability 1 | Up to 7 unicast PDSCHs per slot per CC only in TDM is supported for Capability 1  1) PDSCH(s) for Msg. 4 is included |  | n/a | n/a | This capability is necessary for each SCS. | Optional with capability signalling |
| 5-11b | Up to 4 unicast PDSCHs per slot per CC for different TBs for UE processing time Capability 1 | Up to 4 unicast PDSCHs per slot per CC only in TDM is supported for Capability 1  1) PDSCH(s) for Msg. 4 is included |  | n/a | n/a | This capability is necessary for each SCS. | Optional with capability signalling |
| 5-12 | Up to 2 PUSCHs per slot per CC for different TBs for UE processing time Capability 1 | Up to 2 unicast PUSCHs per slot per CC only in TDM is supported for Capability 1 |  | *pusch-ProcessingType1-DifferentTB-PerSlot* | *FeatureSetUplink* | n/a | n/a | This capability is necessary for each SCS. | Optional with capability signalling |
| 5-12a | Up to 7 PUSCHs per slot per CC for different TBs for UE processing time Capability 1 | Up to 7 unicast PUSCHs per slot per CC only in TDM is supported for Capability 1 |  | n/a | n/a | This capability is necessary for each SCS. | Optional with capability signalling |
| 5-12b | Up to 4 PUSCHs per slot per CC for different TBs for UE processing time Capability 1 | Up to 4 unicast PUSCHs per slot per CC only in TDM is supported for Capability 1 |  | n/a | n/a | This capability is necessary for each SCS. | Optional with capability signalling |
| 5-13 | Up to 2 unicast PDSCHs per slot per CC for different TBs for UE processing time Capability 2 | Up to 2 unicast PDSCHs per slot per CC only in TDM is supported for Capability 2  UE can report values 'X' and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X DL CCs, the UE may expect to be scheduled with up to 2 PDSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled  2) No scheduling limitation  3) N1 based on Table 5.3-2 of TS 38.214 for given SCS from {15, 30, 60} kHz | 5-5a | *pdsch-ProcessingType2* | *FeatureSetDownlink* | n/a | n/a | This capability is necessary for each SCS  More than one set of per SCS per band reports can be signalled for a given band combination | Optional with capability signalling  Candidate values for Component 1:  X in {1, …, 16}, |
| 5-13a | Up to 7 unicast PDSCHs per slot per CC for different TBs for UE processing time Capability 2 | Up to 7 unicast PDSCHs per slot per CC only in TDM is supported for Capability 2  UE can report values 'X' and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X DL CCs, the UE may expect to be scheduled with up to 7 PDSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled  2) No scheduling limitation  3) N1 based on Table 5.3-2 of TS 38.214 for given SCS from {15, 30, 60} kHz | 5-5a | n/a | n//a | This capability is necessary for each SCS  More than one set of per SCS per band reports can be signalled for a given band combination | Optional with capability signalling  Candidate values for Component 1:  X in {1, …, 16}, |
| 5-13c | Up to 4 unicast PDSCHs per slot per CC for different TBs for UE processing time Capability 2 | Up to 4 unicast PDSCHs per slot per CC only in TDM is supported for Capability 2  UE can report values 'X' and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X DL CCs, the UE may expect to be scheduled with up to 4 PDSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled  2) No scheduling limitation  3) N1 based on Table 5.3-2 of TS 38.214 for given SCS from {15, 30, 60} kHz | 5-5a | n/a | n/a | This capability is necessary for each SCS  More than one set of per SCS per band reports can be signalled for a given band combination | Optional with capability signalling  Candidate values for Component 1:  X in {1, …, 16}, |
| 5-13d | Up to 2 PUSCHs per slot per CC for different TBs for UE processing time Capability 2 | Up to 2 unicast PUSCHs per slot per CC only in TDM is supported for Capability 2  UE can report values 'X' and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X UL CCs, the UE may expect to be scheduled with up to 2 PUSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled  2) N2 based on Table 6.4-2 of TS 38.214 for given SCS from {15, 30, 60} kHz | 5-5c | *pusch-ProcessingType2* | *FeatureSetUplink* | n/a | n/a | This capability is necessary for each SCS  More than one set of per SCS per band reports can be signalled for a given band combination | Optional with capability signalling  Candidate values for Component 1:  X in {1, …, 16}, |
| 5-13e | Up to 7 PUSCHs per slot per CC for different TBs for UE processing time Capability 2 | Up to 7 unicast PUSCHs per slot per CC only in TDM is supported for Capability 2  UE can report values 'X' and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X UL CCs, the UE may expect to be scheduled with up to 7 PUSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled  2) N2 based on Table 6.4-2 of TS 38.214 for given SCS from {15, 30, 60} kHz | 5-5c | n/a | n/a | This capability is necessary for each SCS  More than one set of per SCS per band reports can be signalled for a given band combination | Optional with capability signalling  Candidate values for Component 1:  X in {1, …, 16}, |
| 5-13f | Up to 4 PUSCHs per slot per CC for different TBs for UE processing time Capability 2 | Up to 4 unicast PUSCHs per slot per CC only in TDM is supported for Capability 2  UE can report values 'X' and supports the following operation, only when all carriers are self-scheduled and all Capability #2 carriers in a band are of the same numerology  - When configured with less than or equal to X UL CCs, the UE may expect to be scheduled with up to 4 PUSCHs per slot with Capability #2 on all of the configured serving cells for which processingType2Enabled is configured and set to enabled  2) N2 based on Table 6.4-2 of TS 38.214 for given SCS from {15, 30, 60} kHz | 5-5c | n/a | n/a | This capability is necessary for each SCS  More than one set of per SCS per band reports can be signalled for a given band combination | Optional with capability signalling  Candidate values for Component 1:  X in {1, …, 16}, |
| 5-14 | Type 1 configured PUSCH repetitions over multiple slots | K = 2, 4, 8 times repetitions with RV sequences |  | *type1-PUSCH-RepetitionMultiSlots* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-16 | Type 2 configured PUSCH repetitions over multiple slots | K = 2, 4, 8 times repetitions with RV sequences |  | *type2-PUSCH-RepetitionMultiSlots* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-17 | PUSCH repetitions over multiple slots | K = 2, 4, 8 times repetitions |  | *pusch-RepetitionMultiSlots* | *Phy-ParametersCommon* | No | No |  | Mandatory with capability signalling |
| 5-17a | PDSCH repetitions over multiple slots | K = 2, 4, 8 times repetitions |  | *pdsch-RepetitionMultiSlots* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-18 | DL SPS | DL SPS |  | *downlinkSPS* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-19 | Type 1 Configured UL grant | K = 1 |  | *configuredUL-GrantType1* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-20 | Type 2 Configured UL grant | K = 1 |  | *configuredUL-GrantType2* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-21 | Pre-emption indication for DL | Pre-emption indication for DL |  | *pre-EmptIndication-DL* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-22 | CBG-based re-transmission for DL using CBGTI | CBG-based re-transmission for DL using CBGTI |  | *cbg-TransIndication-DL* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-23 | CBGFI for CBG-based re-transmission for DL | CBGFI for CBG-based re-transmission for DL | 5-22 | *cbg-FlushIndication-DL* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-24 | Dynamic HARQ-ACK codebook using sub-codebooks for CBG-based re-transmission for DL | Dynamic HARQ-ACK codebook using sub-codebooks for CBG-based re-transmission for DL |  | *dynamicHARQ-ACK-CodeB-CBG-Retx-DL* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-25 | CBG-based re-transmission for UL using CBGTI | CBG-based re-transmission for UL using CBGTI |  | *cbg-TransIndication-UL* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-26 | Semi-static rate-matching resource set configuration for DL | 1) Bitmap 1/2/3  2) controlResourceSet |  | *rateMatchingResrcSetSemi-Static* | *Phy-ParametersCommon* | No | No |  | Mandatory with capability signalling |
| 5-27 | Dynamic rate-matching resource set configuration for DL | Bitmap 1/2/3 |  | *rateMatchingResrcSetDynamic* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
| 5-27a | Dynamic rate-matching control resource set for DL | Dynamic rate-matching control resource set for DL |  | *rateMatchingCtrlResrcSetDynamic* | *Phy-ParametersCommon* | No | No |  | Mandatory with capability signalling |
| 5-28 | Rate-matching around LTE CRS | Rate-matching around LTE CRS |  | *rateMatchingLTE-CRS* | *BandNR* | n/a | n/a |  | Mandatory with capability signalling |
| 5-29 | LBRM for PUSCH | Limited buffer rate matching in UL |  | *pusch-LBRM* | *Phy-ParametersFRX-Diff* | No | Yes |  | Optional with capability signalling |
| 5-30 | DL scheduling slot offset greater than zero for PDSCH mapping type A | Support of DL scheduling slot offset (K0) greater than zero for PDSCH mapping type A |  | *dl-SchedulingOffset-PDSCH-TypeA* | *Phy-ParametersXDD-Diff*  *Phy-ParametersFRX-Diff* | Yes | Yes |  | Mandatory with capability signalling |
| 5-30a | DL scheduling slot offset greater than zero for PDSCH mapping type B | Support of DL scheduling slot offset (K0) greater than zero for PDSCH mapping type B |  | *dl-SchedulingOffset-PDSCH-TypeB* | *Phy-ParametersXDD-Diff*  *Phy-ParametersFRX-Diff* | Yes | Yes |  | Mandatory with capability signalling |
| 5-31 | UL scheduling slot offset greater than 12 | Support of UL scheduling slot offset (K2) greater than 12 |  | *ul-SchedulingOffset* | *Phy-ParametersXDD-Diff*  *Phy-ParametersFRX-Diff* | Yes | Yes |  | Mandatory with capability signalling |
| 5-32 | Separation of two unicast PDSCHs with a gap | For any two consecutive slots n and n+1, if there are more than 1 unicast PDSCH in either slot, the minimum time separation between starting time of any two unicast PDSCHs within the duration of these slots is  4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | 5-11, 5-11b, 5-13, or 5-13c | *pdsch-SeparationWithGap* | *FeatureSetDownlink-v1540* | No | No | This feature only applies to SCS 30kHz and 60kHz | Optional with capability signalling |
| 5-33 | Separation of two unicast PUSCHs with a gap | For any two consecutive slots n and n+1, if there are more than 1 unicast PUSCH in either slot, the minimum time separation between starting time of any two unicast PUSCHs within the duration of these slots is  2OFDM symbols for 15kHz, 4 OFDM symbols for 30kHz and 7 OFDM symbols for 60kHz | 5-12, 5-12b, 5-13d, or 5-13f | *pusch-SeparationWithGap* | *FeatureSetUplink-v1540* | No | No | This feature only applies to SCS 15kHz, 30kHz and 60kHz | Optional with capability signalling |
| 5-34 | New 64QAM MCS table for PDSCH | New 64QAM MCS table for PDSCH |  | *dl-64QAM-MCS-TableAlt* | *Phy-ParametersFRX-Diff* | No | Yes |  | Optional with capability signalling |
| 5-34a | New 64QAM MCS table for PUSCH | New 64QAM MCS tables for PUSCH with and without transform precoding respectively |  | *ul-64QAM-MCS-TableAlt* | *Phy-ParametersFRX-Diff* | No | Yes |  | Optional with capability signalling |
| 5-34b | Dynamic indication of MCS table with MCS-C-RNTI for PDSCH | Dynamic indication of MCS table using MCS-C-RNTI for PDSCH | 5-34 | *dl-MCS-TableAlt-DynamicIndication* | *FeatureSetDownlink-v1540* | n/a | n/a |  | Optional with capability signalling |
| 5-34c | Dynamic indication of MCS tables with MCS-C-RNTI for PUSCH | Dynamic indication of MCS tables using MCS-C-RNTI for PUSCH | 5-34a | *ul-MCS-TableAlt-DynamicIndication* | *FeatureSetUplink-v1540* | n/a | n/a |  | Optional with capability signalling |
|  | 5-X | Additional CG periodicities | CG Type 1 or CG Type 2 periodicities of integer multiple of slot:  N × slot, where:  - N=(1..640) for SCS=15kHz  - N=(1..1280) for SCS=30kHz  - N=(1..2560) for SCS=60kHz  - N=(1..5120) for SCS=120kHz | 5-19 or 5-20 | *extendedCG-Periodicities-r16* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |
|  | 5-Y | Additional DL SPS periodicities | Downlink SPS periodicities of integer multiple of slot:  N × slot, where:  - N=(1..640) for SCS=15kHz  - N=(1..1280) for SCS=30kHz  - N=(1..2560) for SCS=60kHz  - N=(1..5120) for SCS=120kHz | 5-18 | *extendedSPS-Periodicities-r16* | *Phy-ParametersCommon* | No | No |  | Optional with capability signalling |

<UNCHANGED PART OMITTED>

## 4.2 Layer-2 and Layer-3 features

Table 4.2-1 provides the list of Layer-2 and Layer-3 features, as shown in [4] and the corresponding UE capability field name, as specified in TS 38.331 [2].

Table 4.2-1: Layer-2 and Layer-3 feature list

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Field name in TS 38.331 [2] | Parent IE in TS 38.331 [2] | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Note | Mandatory/Optional |
| 0. General (including supported bearer types) | 0-0 | Basic EN-DC procedures | 1) MCG DRB with LTE/NR PDCP  2) SCG DRB with NR PDCP  3) SN addition, modification, and release via RRC connection reconfiguration  4) Joint processing on the combined RRC messages  5) Failure handling (including both MN and SN) |  | n/a | n/a | n/a | n/a |  | Mandatory without capability signalling |
| 0-1 | Access stratum release | Access stratum release |  | *accessStratumRelease* | *UE-NR-Capability* | No | No |  | Optional with capability signalling and candidate value set is {Rel-15, spare7, … , spare1} |
| 0-2 | SRB | 1) Split SRB with one UL path  2) SRB3 |  | 1) *splitSRB-WithOneUL-Path*  2) *srb3* | *GeneralParametersMRDC-XDD-Diff* | No | No | 2) Not applied to NE-DC. | 1) Optional with capability signalling  2) Mandatory with capability signalling |
| 0-3 | DRB | 1) Maximum number of DRBs  2) Split DRB with one UL path  3) Split DRB with both UL MCG and SCG paths |  | 1), 2) n/a  3) *splitDRB-withUL-Both-MCG-SCG* | 1), 2) n/a  3) *GeneralParametersMRDC-XDD-Diff* | No | No | 2) 8 DRBs are supported regardless of bearer types | 1, 2) Mandatory without UE capability signalling  3) Mandatory with capability signalling |
| 0-4 | Direct SN addition in the first RRC connection reconfiguration after RRC connection establishment | Direct SN addition in the first RRC connection reconfiguration after RRC connection establishment |  | n/a | n/a | n/a | n/a |  | Mandatory without capability signalling |
| 0-5 | IMS voice | 1) IMS voice over NR  2) Fallback HO to LTE for IMS voice  3) 5GC VoLTE  4) IMS voice over SCG bearer of NE-DC |  | 1) *voiceOverNR*  3) *voiceOverEUTRA-5GC*  4) *voiceOverSCG-BearerEUTRA-5GC* | 1) *IMS-ParametersFRX-Diff*  3), 4) *IMS-ParametersCommon* | 1), 3), 4) No | 1) Yes  3), 4) No | 1), 2), 3) SA only  4): NE-DC only | 1) Mandatory with capability signalling if UE is IMS voice capable in NR SA. Otherwise optional with capability signalling.  2) No need for a separate capability signalling.  3) Optional with capability signalling  4) Optional with capability signalling |
| 0-6 | Delay budget reporting | Delay budget reporting |  | *delayBudgetReporting* | *UE-NR-Capability-v1530* | No | No | SA only | Optional with capability signalling |
| 0-7 | PCell operation | 1) PCell operation on FR2 |  | *pCell-FR2* | *Phy-ParametersFR2* | No | No | SA only | Mandatory with capability signalling |
| 0-8 | Overheating | 1) Overheating assistance information |  | *overheatingInd* | *UE-NR-Capability-v1540* | No | No | SA only | Optional with capability signalling |
| 0-9 | V2X | 1) Support of EUTRA V2X |  | *v2x-EUTRA* | *GeneralParametersMRDC-XDD-Diff* | Yes | No | Only applied to EN-DC | Optional with capability signalling |
|  | 0-X | Reference time provisioning | Reference time provisioning |  | *referenceTimeProvision-r16* | *UE-NR-Capability* | No | No |  | Optional with capability signalling |
|  | 0-X+1 | Reference time request | Reference time interest indication |  | *referenceTimeInd-r-16* | *UE-NR-Capability* | No | No |  | Optional with capability signalling |
| 1. PDCP | 1-0 | Basic PDCP procedures | 1) (de)Ciphering on DRB/SRB  2) Integrity protection on SRB  3) Timer based SDU discard  4) Re-ordering and in-order delivery  5) Status reporting  6) Duplicate discarding  7) 18bits SN |  | n/a | n/a | n/a | n/a |  | Mandatory without capability signalling |
| 1-1 | ROHC context | 1) Maximum number of ROHC context sessions  2) Supported ROHC profiles |  | 1) *maxNumberROHC-ContextSessions*  2) *supportedROHC-Profiles* | *PDCP-Parameters* | No | No |  | Optional with capability signaling and candidate value set is:  1) {cs2, cs4, cs8, cs12, cs16, cs24, cs32, cs48, cs64, cs128, cs256, cs512, cs1024, cs16384, spare2, spare1}  2) {0x0000, 0x0001, 0x0002, 0x0003, 0x0004, 0x0006, 0x0101, 0x0102, 0x0103, 0x0104} |
| 1-2 | ROHC context continuation operation | ROHC context continuation operation |  | *continueROHC-Context* | *PDCP-Parameters* | No | No |  | Optional with capability signalling |
| 1-3 | Uplink only ROHC profiles | Uplink only ROHC profiles |  | *uplinkOnlyROHC-Profiles* | *PDCP-Parameters* | No | No |  | Optional with capability signalling |
| 1-4 | Out of order delivery | Out of order delivery |  | *outOfOrderDelivery* | *PDCP-Parameters* | No | No |  | Optional with capability signalling |
| 1-5 | Short SN | Short SN |  | *shortSN* | *PDCP-Parameters* | No | No |  | Mandatory with capability signalling |
| 1-6 | PDCP duplication | 1) PDCP duplication for split SRB1/2  2) PDCP duplication for SRB1/2 and/or SRB3  3) PDCP duplication for MCG or SCG DRB  4) PDCP duplication for split DRB  5) PDCP duplication with more than two RLC entities |  | 1) *pdcp-DuplicationSplitSRB*  2) *pdcp-DuplicationSRB*  3) *pdcp-DuplicationMCG-OrSCG-DRB*  4) *pdcp-DuplicationSplitDRB*  5) *pdcp-DuplicationMoreThanTwoRLC-r16* | 1), 4) *PDCP-ParametersMRDC*  2), 3), 5) *PDCP-Parameters* | No | No |  | Optional with capability signalling |
| 1-7 | DRB IP data rate | 1) DRB IP data rate in DL  2) DRB IP data rate in UL |  | n/a | n/a | n/a | n/a |  | Optional capability is signalled by NAS signalling defined in 24.501 |
|  | 1-X | Ethernet Header Compression | 1) Compression and decompression using EHC protocol  2) Maximum number of EHC contexts  3) EHC context continuation operation |  | 1) *ehc-r16*  2) *maxNumberEHC-Contexts-r16*  3) *continueEHC-Context-r16* | 1), 2), 3) *PDCP-Parameters* | No | No |  | Optional with capability signalling |
| 2. RLC | 2-0 | Basic RLC procedures | 1) RLC TM  2) RLC AM with 18bits SN\*  3) SDU discard |  | n/a | n/a | n/a | n/a | No separate feature is considered for t-PollRetransmit, t-Reassembly and t-StatusProhibit | Mandatory without capability signalling |
| 2-1 | RLC AM with short SN | RLC AM with short SN |  | *am-WithShortSN* | *RLC-Parameters* | No | No |  | Mandatory with capability signalling |
| 2-2 | RLC UM with short SN | RLC UM with short SN |  | *um-WithShortSN* | *RLC-Parameters* | No | No |  | Mandatory with capability signalling |
| 2-3 | RLC UM with long SN | RLC UM with long SN |  | *um-WithLongSN* | *RLC-Parameters* | No | No |  | Mandatory with capability signalling |
| 2-4 | NR RLC SN size for SRB | NR RLC SN size for SRB |  | n/a | n/a | n/a | n/a |  | RAN2 decided only short RLC SN is used for SRB. |
| 3. MAC | 3-0 | Basic MAC procedures | 1) RA procedure on PCell or PSCell (in case of EN-DC)  2) UE initiated RA procedure (including for beam recovery purpose)  3) NW initiated RA procedure (i.e. based on PDCCH)  4) Support of ssb-Threshold and association between preamble/PRACH occasion and SSB  5) Preamble grouping  6) UL single TA maintenance  7) HARQ operation for DL and UL  8) LCH prioritization  9) Prioritized bit rate  10) Multiplexing  11) SR with single SR configuration  12) BSR  13) PHR  14) 8bits and 16bits L field |  | n/a | n/a | n/a | n/a |  | Mandatory without capability signallling |
| 3-1 | LCP restriction | 1) LCP restriction  2) LCP restriction to SCell(s)  3) LCH to Configured Grant configuration mapping  4) PHY priority indication-based restriction |  | 1) *lcp-Restriction*  2) *lch-ToSCellRestriction*  3) *lch-ToConfiguredGrant-Mapping-r16*  4) *lch-ToGrantPriorityRestriction-r16* | *MAC-ParametersCommon* | No | No |  | Optional with capability signalling |
| 3-2 | LCH SR delay timer | LCH SR delay timer |  | *logicalChannelSR-DelayTimer* | *MAC-ParametersXDD-Diff* | Yes | No |  | Optional with capability signalling |
| 3-3 | DRX | 1) DRX with long DRX cycle  2) DRX with short DRX cycle |  | 1) *longDRX-Cycle*  2) *shortDRX-Cycle* | *MAC-ParametersXDD-Diff* | Yes | No |  | Mandatory with capability signalling |
| 3-4 | Configured grants | Maximum number of configured grant configurations per cell group |  | *multipleConfiguredGrants* | *MAC-ParametersXDD-Diff* | Yes | No |  | Optional with capability signalling |
| 3-5 | SR | Multiple SR configurations |  | *multipleSR-Configurations* | *MAC-ParametersXDD-Diff* | Yes | No |  | Optional with capability signalling |
| 3-6 | Skipping UL transmission | 1) Skipping UL transmission for dynamic UL grant  2) Skipping UL transmission for configured UL grant |  | 1) *skipUplinkTxDynamic* | *MAC-ParametersXDD-Diff* | 1) Yes  2) No | No |  | 1) Optional with capability signalling. Mandatory with capability signalling from Rel-16  2) Conditional mandatory if the UE supports configured grant |
| 3-7 | Codec adaptation | 1) Bit rate recommendation message  1) Bit rate recommendation query message |  | 1) *recommendedBitRate*  2) *recommendedBitRateQuery* | *MAC-ParametersCommon* | No | No | SA only | Optional with capability signalling |
|  | 3-X | Intra-UE prioritization | 1) LCH priority-based prioritization  2) Autonomous MAC PDU transmission |  | 1) *lch-PriorityBasedPrioritization-r16*  2) *autonomousTransmission-r16* | *MAC-ParametersCommon* | No | No |  | Optional with capability signalling |

Editor’s note: FFS whether additional capability or related signalling is needed for joint EHC and ROHC operation.

Editor’s note: It is FFS whether to support allowing CG periodicities of multiple of 2/7 symbols as a separate capability with a cross-slot boundary capability as a pre-requisite.

Editor’s note: It is FFS whether LCH based prioritization can be supported without PHY prioritization. It is expected this can be discussed once RAN1 has defined feature/capability related to PHY layer prioritization