**3GPP TSG RAN WG1 #101-e R1-2005097**

**e-Meeting, 25th May – 5th June, 2020**

**Agenda item:** 7.2.11

**Source:** Moderators (AT&T, NTT DOCOMO, INC.)

**Title:** RAN1 UE features list for Rel-16 NR after RAN1#101-e

**Document for:** Information

1. Introduction

This contribution includes Rel-16 NR RAN1 UE features list based on the agreements made at RAN1#101-e meeting.

1. NR\_2step\_RACH

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 9. NR\_2step\_RACH | 9-1 | Basic channel structure and procedure of 2-step RACH | 1. Fallback procedures from 2-step RACH to 4-step RACH 2. msgA PRACH resource and format determination 3. msgA PUSCH configuration 4. Validation and transmission of MsgA PRACH and PUSCH 5. Mapping between preamble of MsgA PRACH and PUSCH occasion with DMRS resource of MsgA PUSCH 6. msgB monitoring and decoding 7. PUCCH transmission for HARQ-ACK feedback to a msgB 8. Power control for msgA PRACH, msgA PUSCH and PUCCH carrying HARQ-ACK feedback to msgB   Note:  1. Components are not exhaustive list and whether/how to capture them is up to RAN2  2. From RAN1 perspective, UE behavior supported for msgB window extended up to 40ms is a part of basic feature group for 2-step RACH separately from NR-U feature group, i.e., FG10-2f. It is up to RAN2 to capture the above description if needed. |  | Yes (but gNB does not need to know whether FG9-1 is supported or not for UEs before RRC connection) | N/A | UE cannot initiate a 2-step RACH process, and thus would not be expected understand the 2-step RACH configurations | per UE | No | No | N/A |  | Optional with capability signalling |
| 9. NR\_2step\_RACH | 9-3 | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA with msgA in PCell/PScell | 4-26, 9-1 | Yes | N/A | UE cannot transmit an MsgA and other UL transmissions in parallel across CCs in inter-band CA | Per BC | N/A | N/A | N/A |  | Optional with capability signalling |
| 9. NR\_2step\_RACH | 9-4 | MsgA operation in a band combination including SUL | MsgA operations in a band combination including SUL | 9-1, 6-16 | Yes | N/A | UE does not support msgA operations in a band combination including SUL | Per BC | N/A | N/A | N/A |  | Optional with capability signalling |
| 9. NR\_2step\_RACH | [9-6] | [up to X of msgBs per slot/within the msgB window] | [up to X of msgBs per slot/within the msgB window] | TBD | Yes | N/A |  | [Per band] | N/A | N/A | N/A | RAN2 to make final decision on whether this FG is needed or not considering the maximum payload size of msgB | Optional with capability signalling |

1. NR-unlicensed

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 10. NR-unlicensed | 10-1 | UL channel access for dynamic channel access mode | 1. Type 1 channel access and contention window size adjustment  2. Type 2A channel access  3. Type 2B channel access  4. Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol for PUSCH/PUCCH transmission |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-1a | UL channel access for semi-static channel access mode | 1. Type 2C channel access  2. Single sensing slot of 9us channel access  3. 20MHz LBT bandwidth  4. CP extension up to 1 symbol for PUSCH/PUCCH transmission |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2 | SSB-based RRM for dynamic channel access mode | 1. SSB-based RRM with Q for dynamic channel access mode |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Q indicates the value of RAN1 parameter | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2a | SSB-based RRM for semi-static channel access mode | 1. SSB-based RRM with Q for semi-static channel access mode, when SMTC window is no longer than the fixed frame period |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Q indicates the value of RAN1 parameter | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2b | MIB reading on unlicensed cell | 1. MIB reading on unlicensed cell for PCell and PSCell |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2c | SSB-based RLM for dynamic channel access mode | 1. SSB-based RLM with Q for dynamic channel access mode |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Q indicates the value of RAN1 parameter | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2d | SSB-based RLM for semi-static channel access mode | 1. SSB-based RLM with Q for semi-static channel access mode, when DRS window is no longer than the fixed frame period |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Q indicates the value of RAN1 parameter | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2e | SIB1 reception on unlicensed cell | 1. SIB1 reception on unlicensed cell for PCell |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2f | Support monitoring of extended RAR window | 1. Support of RAR extension from 10ms to 40ms by decoding of the 2-bit SFN indication in DCI 1\_0 |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-2g | SSB-based BFD/CBD for dynamic channel access mode | SSB-based BFD/CBD with Q for dynamic channel access mode |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Q indicates the value of RAN1 parameter | Optional with capability signaling |
| 10. NR-unlicensed | 10-2h | SSB-based BFD/CBD for semi-static channel access mode | SSB-based BFD/CBD with Q for semi-static channel access mode |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Q indicates the value of RAN1 parameter | Optional with capability signaling |
| 10. NR-unlicensed | 10-2i | CSI-RS-based BFD/CBD for NR-U | CSI-RS-based BFD/CBD for NR-U |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling |
| 10. NR-unlicensed | 10-7 | UL channel access for 10 MHz SCell | 1. 10 MHz LBT bandwidth | one of {10-1, 10-1a} | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling |
| 10. NR-unlicensed | 10-10 | RSSI and channel occupancy measurement and reporting | 1. RSSI measurement 2. Channel occupancy reporting |  | Yes | N/A |  | Per band | N/A | N/A | N/A | the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling |
| 10. NR-unlicensed | 10-11 | SRS starting position at any OFDM symbol in a slot | 1. Support transmitting SRS starting in all symbols (0,…,13) of a slot |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling |
| 10. NR-unlicensed | 10-20 | Support search space set configuration with freqMonitorLocation-r16 | 1. Maximum number of frequency domain locations for a search space set configuration with freqMonitorLocations-r16 |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Candidate values of component 1: {1, 2, ,3, 4, 5}  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling |
| 10. NR-unlicensed | 10-20a | Support coreset configuration with rb-Offset | 1. Support coreset configuration with rb-Offset |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling |
| 10. NR-unlicensed | 10-23 | CGI reading on unlicensed cell for ANR functionality | 1. Support acquisition of relevant information from a neighbouring NR unlicensed cell in an unlicensed carrier by reading the RMSI of the neighbouring unlicensed cell and reporting the acquired information to the network |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Support reading RMSI from an unlicensed cell for ANR | Optional with capability signaling |
| 10. NR-unlicensed | 10-25 | Enable configured UL transmissions when SFI field in DCI 2\_0 is configured but DCI 2\_0 is not detected | 1. Support configuration of enableConfiguredUL-r16 and enable transmission of higher-layer configured UL \*SRS, PUCCH, CG-PUSCH etc) when SFI field in DCI 2\_0 is configured but DCI 2\_0 is not detected |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling |
| 10. NR-unlicensed | 10-27 | Wideband PRACH | 1. Enhanced PRACH design for NR-U by adopting a single long ZC sequence, with ZC sequence = 1151 for 15kHz and ZC sequence = 571 for 30kHz |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-29 | Support available RB set indicator field in DCI 2\_0 | 1. Support monitoring DCI 2\_0 to read availableRB-Sets-r16 |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-30 | Support channel occupancy duration indicator field in DCI 2\_0 | 1. Support monitoring DCI 2\_0 to read COT duration |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling  This FG may be a part of basic operation for a particular scenario |
| 10. NR-unlicensed | 10-8 | Type B PDSCH length {3, 5, 6, 8, 9, 10, 11, 12, 13} without DMRS shift due to CRS collision | 1. Type B PDSCH length {3, 5, 6, 8, 9, 10, 11, 12, 13} without DMRS shift due to CRS collision | 5-6a | Yes | N/A |  | Per band | N/A | N/A | N/A | Note length 9/10 with DMRS shift due to CRS collision are already covered by 14-2 | Optional with capability signalling |
| 10. NR-unlicensed | 10-9 | Search space set group switching with DCI 2\_0 monitoring | 1. Two groups of search space sets  2. Monitor DCI 2\_0 with a search space set switching field  3. Support switching the search space set group with PDCCH decoding in group 1  4. Support a timer to switch back to original search space set group  5. Monitor DCI 2\_0 for channel occupancy time and use the end of channel occupancy time to switch back to the original search space set group |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Being configured with two groups of search spaces, and switch between them. Some search space sets can be configured in both groups. | Optional with capability signalling |
| 10. NR-unlicensed | 10-9b | Search space set group switching with implicit PDCCH decoding without DCI 2\_0 monitoring | 1. Two groups of search space sets  2. Support switching the search space set group with PDCCH decoding in group 1  3. Support a timer to switch back to original search space set group |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Being configured with two groups of search spaces, and switch between them. Some search space sets can be configured in both groups. | Optional with capability signalling |
| 10. NR-unlicensed | 10-9c | Joint search space group switching across multiple cells | 1. Configured with a group of cells and switch search space set group jointly over these cells | one of {10-9, 10-9b} | Yes | N/A |  | Per BC | N/A | N/A | N/A | Without this capability, the UE will switch search space set groups for different cells independently | Optional with capability signalling |
| 10. NR-unlicensed | 10-9d | Support Search space set group switching capability 2 | 1. Search space set group switching Capability-2: P=10/12/22 symbols for µ = 0/1/2 SCS | one of {10-9, 10-9b} | Yes | N/A |  | Per band | N/A | N/A | N/A | Without this capability, the UE supports search space set group switching capability-1: P=25/25/25 symbols for µ=0/1/2 | Optional with capability signalling |
| 10. NR-unlicensed | 10-14 | Non-numerical PDSCH to HARQ-ACK timing | 1. Support configuration of a value for dl-DataToUL-ACK indicating an inapplicable time to report HARQ ACK |  | Yes | N/A |  | Per band | N/A | N/A | N/A | If non-numerical K1 value is supported  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
| 10. NR-unlicensed | 10-15 | Enhanced dynamic HARQ codebook | 1. Support of bit fields signalling PDSCH HARQ group index and NFI in DCI 1\_1 (configuration of nfi-TotalDAI-Included)  2. Support of bit field in DCI 0\_1 for other group total DAI if configured. (configuration of ul-TotalDAI-Included)  3. Support the retransmission of HARQ ACK (pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16) |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Enhanced dynamic HARQ codebook supporting grouping of HARQ ACK and triggering the retransmission of HARQ ACK in each groups | Optional with capability signalling |
| 10. NR-unlicensed | 10-16 | One-shot HARQ ACK feedback | 1. Support feedback of type 3 HARQ-ACK codebook, triggered by a DCI 1\_1 scheduling a PDSCH 2. Support feedback of type 3 HARQ-ACK codebook , triggered by a DCI 1\_1 without scheduling a PDSCH using a reserved FDRA value |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Upon triggering, UE reports A/N for all HARQ processes and all CCs in a PUCCH group. | Optional with capability signalling |
| 10. NR-unlicensed | 10-17 | Multi-PUSCH UL grant | 1. Support of scheduling up to 8 PUSCH with a single DCI 0\_1 |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 10. NR-unlicensed | [10-19a] | DL wideband carrier operation mode 1 | Support of DL wideband carrier operation mode 1: single carrier wideband operation when LBT is successful in all LBT sub-bands of [BWP/carrier] |  | Yes | N/A |  | Per band | N/A | N/A | N/A | These FGs 10-19a/b/c/d/e/f are examples on what RAN1 ask RAN2 to reserve capability bits in LS R1-2004965 | Optional with capability signalling |
| 10. NR-unlicensed | [10-19b] | DL wideband carrier operation mode 2 | Support of DL wideband carrier operation mode 2: single wideband carrier when LBT is successful in a subset of the LBT sub-bands which are contiguous |  | Yes | N/A |  | Per band | N/A | N/A | N/A | These FGs 10-19a/b/c/d/e/f are examples on what RAN1 ask RAN2 to reserve capability bits in LS R1-2004965 | Optional with capability signalling |
| 10. NR-unlicensed | [10-19c] | DL wideband carrier operation mode 3 | Support of DL wideband carrier operation mode 3: single wideband carrier when LBT is successful in a subset of the LBT sub-bands which are non-contiguous |  | Yes | N/A |  | Per band | N/A | N/A | N/A | These FGs 10-19a/b/c/d/e/f are examples on what RAN1 ask RAN2 to reserve capability bits in LS R1-2004965 | Optional with capability signalling |
| 10. NR-unlicensed | [10-19d] | UL wideband carrier operation mode 1 | Support of UL wideband carrier operation mode 1: UE transmits only if LBT passes for all LBT sub-bands of BWP |  | Yes | N/A |  | Per band | N/A | N/A | N/A | These FGs 10-19a/b/c/d/e/f are examples on what RAN1 ask RAN2 to reserve capability bits in LS R1-2004965 | Optional with capability signalling |
| 10. NR-unlicensed | [10-19e] | UL wideband carrier operation mode 2A | Support of UL wideband carrier operation mode 2A: UE transmits if LBT passes for single scheduled LBT sub-band |  | Yes | N/A |  | Per band | N/A | N/A | N/A | These FGs 10-19a/b/c/d/e/f are examples on what RAN1 ask RAN2 to reserve capability bits in LS R1-2004965 | Optional with capability signalling |
| 10. NR-unlicensed | [10-19f] | UL wideband carrier operation mode 2B | Support of UL wideband carrier operation mode 2B: UE transmits if LBT passes for scheduled multiple contiguous LBT sub-bands |  | Yes | N/A |  | Per band | N/A | N/A | N/A | These FGs 10-19a/b/c/d/e/f are examples on what RAN1 ask RAN2 to reserve capability bits in LS R1-2004965 | Optional with capability signalling |
| 10. NR-unlicensed | 10-26 | CSI-RS based RLM for NR-U | CSI-RS based RLM for NR-U |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 10. NR-unlicensed | 10-26a | CSI-RS based RRM for NR-U | CSI-RS based RRM for NR-U |  | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 10. NR-unlicensed | [10-31] | [Support of CSI-RS measurements for CSI reporting and tracking without COT duration from DCI 2\_0] | [· Perform CSI measurements for reporting and tracking using CSI-RS resources that are not within a COT duration indicated by DCI 2\_0  · Note: This includes the cases when DCI 2\_0 is not configured and when DCI 2\_0 is configured but COT duration is not provided by either CO duration field or SFI.] | TBD | Yes | N/A |  | [Per band] | N/A | N/A |  |  | Optional with capability signaling |
| 10. NR-unlicensed | 10-3 | PRB interlace mapping for PUSCH | 1. PRB interlace frequency domain resource allocation for PUSCH |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Support of PRB interlace PUSCH | Optional with capability signalling |
| 10. NR-unlicensed | 10-3a | PRB interlace mapping for PUCCH | 1. PRB interlace frequency domain resource allocation for PUCCH format 0 and format 1 2. PRB interlace frequency domain resource allocation for PUCCH format 2 3. PRB interlace frequency domain resource allocation for PUCCH format 3 |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Support of PRB interlace PUCCH format 0/1 | Optional with capability signalling |
| 10. NR-unlicensed | 10-12 | OCC for PRB interlace mapping for PF2 and PF3 | 1. OCC2  2. OCC4 | 10-3a | Yes | N/A |  | Per band | N/A | N/A | N/A | UE OCC capability for EPF2/EFP3 | Optional with capability signalling |
| 10. NR-unlicensed | 10-13a | Extended CP range of more than one symbol for CG-PUSCH | 1. UE supports generating a CP extension of length longer than 1 symbol for Configured Grant PUSCH transmission | One or both of {5-19, 5-20} | Yes | N/A |  | Per band | N/A | N/A | N/A | How long a UE can generate the CP extension beyond 1 symbol for CG-PUSCH | Optional with capability signalling |
| 10. NR-unlicensed | 10-18 | Configured grant with retransmission in CG resources | 1. Support retransmission in CG resources  2. Support configured grant retransmission timer  3. Support DFI monitoring  4. Support CG-UCI in CG-PUSCH | One or both of {5-19, 5-20} | Yes | N/A |  | Per band | N/A | N/A | N/A | Support configured grant with retransmission in configured grant resource | Optional with capability signalling |
| 10. NR-unlicensed | 10-21a | Support using ED threshold given by gNB for UL to DL COT sharing | 1. Use ULtoDL-CO-SharingED-Threshold-r16 for Type 1 channel access for scheduled UL to share COT with gNB for DL  2. Use ULtoDL-CO-SharingED-Threshold-r16 for Type 1 channel access for CG-PUSCH to share COT with gNB for DL  3. Indicate in CG-UCI the COT sharing information | 10-1 | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 10. NR-unlicensed | 10-21b | Support UL to DL COT sharing | 1. Support Type 1 LBT for scheduled UL to share COT with gNB for DL without ULtoDL-CO-SharingED-Threshold-r16  2. Support Type 1 LBT for CG-PUSCH to share COT with gNB for DL without ULtoDL-CO-SharingED-Threshold-r16  3. Indicate in CG-UCI the COT sharing information | 10-1 | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signaling |
| 10. NR-unlicensed | 10-24 | CG-UCI multiplexing with HARQ ACK | 1. Support multiplexing CG-UCI with HARQ ACK | 10-18 | Yes | N/A |  | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 10. NR-unlicensed | 10-28 | Configured grant with Rel-16 enhanced resource configuration | 1. Support configuration of resources with cg-nrofSlots-r16 and cg-nrofPUSCH-InSlot-r16, | One or both of {5-19, 5-20} | Yes | N/A |  | Per band | N/A | N/A | N/A | the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |

1. NR\_L1enh\_URLLC

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 11.  NR\_L1enh\_URLLC | 11-1 | Monitoring DCI format 1\_2 and DCI format 0\_2 | 1. Supports monitoring DCI format 1\_2 for DL scheduling 2. Supports monitoring DCI format 0\_2 for UL scheduling |  | Yes | N/A |  | Per UE | No | No | N/A |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-1a | Monitoring both DCI format 0\_1/1\_1 and DCI format 0\_2/1\_2 in the same search space | 1. Supports monitoring both DCI format 0\_1/1\_1 and DCI format 0\_2/1\_2 in the same search space | 11-1 | Yes | N/A |  | Per UE | No | No | N/A |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-1b | Type 1 HARQ-ACK codebook support for relative TDRA for DL | 1. Support Type 1 HARQ-ACK codebook for TDRA using the starting symbol of the PDCCH monitoring occasion in which the DL assignment is detected as the reference of the SLIV | 11-1 | Yes | N/A |  | Per UE | No | Yes  Note: Differentiation is from the perspective of the scheduled carrier | N/A |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-2 | Rel-16 PDCCH monitoring capability | 1. Supported combination(s) of (X, Y, μ). For each reported combination, the UE supports the limit C on the maximum number of non-overlapped CCEs for channel estimation per PDCCH monitoring span and the limit M on the maximum number of monitored PDCCH candidates per PDCCH monitoring span 2. Maximum number of DL and UL unicast DCI formats in a span   For the set of monitoring occasions which are within the same span:   * Processing one unicast DCI scheduling DL and one unicast DCI scheduling UL per scheduled CC across this set of monitoring occasions for FDD * Processing one unicast DCI scheduling DL and two unicast DCI scheduling UL per scheduled CC across this set of monitoring occasions for TDD * Processing two unicast DCI scheduling DL and one unicast DCI scheduling UL per scheduled CC across this set of monitoring occasions for TDD |  | Yes | N/A |  | Per FS for component 1  Note: Indicating support of this capability in a band in a BC implies that only rel-16 monitoring can be configured in a CA configuration for the BC if the CA configuration includes the band and if rel-16 monitoring is configured for the band | N/A | N/A | N/A | This capability is signaled for SCS 15 kHz and 30 kHz.  For μ=0 and 1, candidate value set for (X, Y, μ): {(7, 3, μ), (4, 3, μ), (2, 2, μ)}  For component 1, a list of separate UE capabilities (X, Y, μ)for processing capability #1;  For component 1, a list of separate UE capabilities (X, Y, μ)for processing capability #2; | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-2a | Capability on the number of CCs for monitoring a maximum number of BDs and non-overlapped CCEs per span when configured with DL CA with Rel-16 PDCCH monitoring capability on all the serving cells | 1. Capability on the number of CCs for monitoring a maximum number of BDs and non-overlapped CCEs per span when configured with DL CA with Rel-16 PDCCH monitoring capability on all the serving cells    * Candidate value for the component: {2, 3, …, 16} | 11-2 | Yes | N/A |  | Per BC | N/A | N/A | N/A |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-2b | Mix of Rel. 16 PDCCH monitoring capability and Rel. 15 PDCCH monitoring capability on different carriers | 1. Support Rel-15 monitoring capability and Rel-16 monitoring capability on different serving cells | 11-2 | Yes | N/A |  | Per FS  Note: Per FS is selected because same type with 3-5b is preferred | N/A | N/A | N/A |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-2c | Number of carriers for CCE/BD scaling with DL CA with mix of Rel. 16 and Rel. 15 PDCCH monitoring capabilities on different carriers | 1. Supported combination(s) of (pdcch-BlindDetectionCA-R15, pdcch-BlindDetectionCA-R16)    * Candidate values for pdcch-BlindDetectionCA-R15 is 1 to 15    * Candidate values for pdcch-BlindDetectionCA-R16 is 1 to 15 | 11-2b | Yes | N/A |  | Per BC | N/A | N/A | N/A | The minimum of the summation of capability on the number of CCs with Rel-15 PDCCH monitoring capability and the capability on the number of CCs with Rel-16 PDCCH monitoring capability is 3 | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-3 | More than one PUCCH for HARQ-ACK transmission within a slot | 1. Supports sub-slot based HARQ-ACK feedback procedure.   • A UL slot consists of a number of sub-slots. No more than one transmitted PUCCH carrying HARQ-ACKs starts in a sub-slot.  • At least one sub-slot configuration for PUCCH can be UE specifically configured to a UE.  • Supports a single configuration for PUCCH resource for all sub-slots in a slot. The starting symbol of a PUCCH resource is defined with respect to the first symbol of sub-slot. Any sub-slot PUCCH resource is not across sub-slot boundaries.   1. Supported sub-slot configuration 2. [Supported combinations of (A, B), where A is the minimum gap between sub-slots containing actual PUCCH transmissions measured from beginning to beginning of the sub-slots, including across slots, and B is the sub-slot duration, with both A and B in units of symbols] |  | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] | Candidate value set for component 2:  { 7-symbol\*2, 2-symbol\*7 and 7-symbol\*2} for NCP or { 6-symbol\*2, 2-symbol\*6 and 6-symbol\*2} for ECP  The number of PUCCHs for CSI reporting per slot is not impacted compared with Rel-15 by introducing the new HARQ-ACK CBs  A UE supporting 11-3 is also expected to support FGs 4-1, 4-3, 4-4, 4-5, and 4-19 with a “slot” being replaced by a sub-slot of length 2 or 7 symbols for NCP and (2 and 6 symbols for ECP) for the PUCCH formats that can be accommodated in the corresponding sub-slot durations  [Candidate value set for component 3):  (A, B) =  {(7, 7),  (4, 2) and (7, 7),  (2, 2) and (7, 7)}]  FFS: Whether to keep component 3) and accordingly the above note for component 3) | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-3c] | 2 PUCCH of format 0 or 2 for a single 7\*2 subslot based HARQ-ACK codebook | 1) 2 PUCCH format 0/2 in different symbols and once per subslot for HARQ-ACK,  2) 2 PUCCH format 0 in different symbols and once per subslot for SR | 11-3 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-3d] | 2 PUCCH of format 0 or for a single 2\*7 subslot based HARQ-ACK codebook | 1) 2 PUCCH format 0/2 in different symbols and once per subslot for HARQ-ACK,  2) 2 PUCCH format 0 in different symbols and once per subslot for SR | 11-3 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-3e] | 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for a single 2\*7-symbol HARQ-ACK codebooks | If the UE supports a 2\*7-symbol subslot HARQ-ACK codebook, the UE also supports:  1) 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 and 4 in the same subslot | 11-3 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-3f] | 2 PUCCH transmissions in the same subslot for a single 2\*7-symbol HARQ-ACK codebooks which are not covered by 11-3d and 11-3e | If the UE supports a 2\*7 subslot HARQ-ACK codebook, the UE also supports:  2 PUCCH transmissions in the same subslot for a single 2\*7-symbol HARQ-ACK codebooks which are not covered by 11-3d and 11-3e | 11-3 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-3g] | SR/HARQ-ACK multiplexing once per subslot using a PUCCH (or HARQ-ACK piggybacked on a PUSCH) when SR/HARQ-ACK are supposed to be sent with different starting symbols in a subslot | If a UE supports a subslot based HARQ-ACK codebook, the UE also supports:  Overlapping PUCCH resources with different starting symbols in a subslot | 11-3 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-4 | Two HARQ-ACK codebooks with up to one sub-slot based HARQ-ACK codebook (i.e. slot-based + slot-based, or slot-based + sub-slot based) simultaneously constructed for supporting HARQ-ACK codebooks with different priorities at a UE | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed with the restriction up to one sub-slot based HARQ-ACK codebook. 2. Supports separate PUCCH configuration for different HARQ-ACK codebooks 3. Supports 2-level priority of HARQ-ACK for dynamically scheduled PDSCH and SPS PDSCH. 4. [Supports a DCI format (from the formats 1\_1/1\_2) scheduling PDSCH with different HARQ-ACK priorities when only DCI format 0\_1/1\_1 is configured or only DCI format 0\_2/1\_2 is configured per BWP] 5. Supports separate configuration of parameters PDSCH-HARQ-ACK-Codebook, UCI-OnPUSCH and ‘codeBlockGroupTransmission” for different HARQ-ACK codebooks. 6. [Supported maximum number of actual PUCCH transmissions for HARQ-ACK within a slot] 7. Support intra-UE multiplexing/prioritization of UL overlapping channels/signals with two priority levels for HARQ-ACK |  | Yes | N/A |  | Per FS  Per FS is selected because in bands or BCs with large number of carriers or large BW, the UE’s procesing power is spent on PDCCH/PDSCH decoding, and hence in some cases the support of the new codebook or some codebook configurations may not be possible | N/A | N/A | N/A | If a UE reports both 11-3 and 11-4, it can support two slot-based HARQ-ACK codebooks, and one slot-based and one-sub-slot-based HARQ-ACK codebooks. If a UE reports 11-4 but not 11-3, it can only support two slot-based HARQ-ACK codebooks.  The number of PUCCHs for CSI reporting per slot is not impacted compared with Rel-15 by introducing the new HARQ-ACK CBs | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-4a | Two sub-slot based HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities at a UE | 1. Supports two sub-slot based HARQ-ACK codebooks with different priorities to be simultaneously constructed. 2. Supports separate PUCCH configuration for different HARQ-ACK codebooks 3. Supports 2-level priority of HARQ-ACK for dynamically scheduled PDSCH and SPS PDSCH. 4. [Supports a DCI format (from the formats /1\_1/1\_2) scheduling PDSCH with different HARQ-ACK priorities when only DCI format 0\_1/1\_1 is configured or only DCI format 0\_2/1\_2 is configured in USS per BWP] 5. Supports separate configuration of parameters PDSCH-HARQ-ACK-Codebook, UCI-OnPUSCH and ‘codeBlockGroupTransmission” for different HARQ-ACK codebooks. 6. [Supported maximum number of actual PUCCH transmissions for HARQ-ACK within a slot] | 11-3 and 11-4 | Yes | N/A |  | Per FS  Per FS is selected because in bands or BCs with large number of carriers or large BW, the UE’s procesing power is spent on PDCCH/PDSCH decoding, and hence in some cases the support of the new codebook or some codebook configurations may not be possible | N/A | N/A | N/A | The number of PUCCHs for CSI reporting per slot is not impacted compared with Rel-15 by introducing the new HARQ-ACK CBs | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-4b | DL priority indication in DCI with mixed DCI formats | 1. Support of priority indicator field configured in DCI formats 1\_1 and 1\_2 in a BWP when configured to monitor both DCI formats 1\_1 and 1\_2 in the BWP | 11-1, 11-4 | Yes | N/A |  | Per UE | No | No | N/A |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-4c] | 2 PUCCH of format 0 or 2 for Two HARQ-ACK codebooks with up to one 7\*2-symbol sub-slot based HARQ-ACK codebook | If the UE supports a 7\*2-symbol subslot HARQ codebook, the UE also supports:  1) 2 PUCCH format 0/2 in different symbols and once per subslot for HARQ-ACK,  2) 2 PUCCH format 0 in different symbols and once per subslot for SR | 11-4 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-4d] | 2 PUCCH of format 0 or 2 in consecutive symbols for two HARQ-ACK codebooks with up to one 2\*7-symbol sub-slot based HARQ-ACK codebook | If the UE supports a 2\*7-symbol subslot HARQ codebook, the UE also supports:  1) 2 PUCCH format 0/2 in different symbols and once per subslot for HARQ-ACK,  2) 2 PUCCH format 0 in different symbols and once per subslot for SR | 11-4 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-4e] | 2 PUCCH of format 0 or 2 for two subslot based HARQ-ACK codebooks | If the UE supports two subslot HARQ codebooks, the UE also supports:  1) 2 PUCCH format 0/2 in different symbols and once per subslot per codebook for HARQ-ACK,  2) 2 PUCCH format 0 in different symbols and once per subslot per codebook for SR | 11-4a | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-4f] | 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for HARQ-ACK codebooks with up to one 2\*7-symbol subslot based HARQ-ACK codebook | If the UE supports a 2\*7 subslot HARQ-ACK codebook, the UE also supports:  1) 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 and 4 in the same subslot of the codebook | 11-4 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-4g] | 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for two subslot based HARQ-ACK codebooks | If the UE supports two subslot HARQ-ACK codebooks both configured with 2\*7 symbols, the UE also supports:  1) 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 and 4 in the same subslot of a codebook | 11-4a | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-4h] | 2 PUCCH transmissions in the same subslot for two HARQ-ACK codebooks with up to one 2\*7-symbol subslot which are not covered by 11-4c and 11-4e | If the UE supports two HARQ-ACK codebooks with up to one subslot based codebook with 2\*7-symbol configuration, the UE also supports:  1) 2PUCCH transmissions in the same subslot of the codebook which are not covered by 11-4c and 11-4e | 11-4 | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | [11-4i] | 2 PUCCH transmissions in the same subslot for two subslot based HARQ-ACK codebooks  which are not covered by 11-4d and 11-4f | If the UE supports two HARQ-ACK codebooks both with 2\*7-symbol configuration, the UE also supports:  1) 2PUCCH transmissions in the same subslot of a codebook which are not covered by 11-4d and 11-4f | 11-4a | Yes | N/A |  | TBD | TBD | TBD | TBD |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-5 | PUSCH repetition Type B | 1. For a transport block, one dynamic UL grant or one configured grant schedules two or more PUSCH repetitions that can be in one slot, or across slot boundary in consecutive available slots. 2. Dynamic indication of the nominal number of repetitions in the DCI scheduling dynamic PUSCH. 3. The time window within which valid symbols are used for transmission is L\*K, starting from the first symbol indicated by the SLIV in TDRA field. 4. PUSCH repetition type B is supported for DCI format 0\_1 and DCI format 0\_2 (for DG and type 2 CG). 5. S and L are separately indicated (4-bit for S and 4-bit for L). L <= 14. 6. Handling of interaction with DL/UL directions depending on whether dynamic SFI is configured or not, including both cases with and without higher layer parameter InvalidSymbolPattern configured 7. Supported maximum number of PUSCH transmissions within a slot for all TB(s), where each actual repetition for PUSCH repetition type B is counted as 1 PUSCH transmission, separately reported for UE processing capability 1 and for UE processing capability 2 if UE supports both processing capabilities   Note: Number of TBs are based on reported Rel-15 capability on number of TBs, and reported value for component 7 cannot be smaller than the reported value of the number of TBs   1. Supported PUSCH hopping scheme |  | Yes | N/A |  | Per FS  Note: Per FS is selected to follow Rel-15 reporting type for number of TBs to be supported | N/A | N/A | N/A | Candidate value for component 7: {2, 3, 4, 7, 8, 12}  Candidate value for component 8: {Inter-slot hopping, Inter-repetition hopping, both Inter-slot hopping and Inter-repetition hopping}  PUSCH repetition type B with configured grant is applied only if UE reports the support of FG 5-19 or FG 5-20, and subjected to the capability of FG 5-19 and FG 5-20  The case that both dynamic SFI and InvalidSymbolPattern are configured is applied only if UE reports the support of FG3-6 |  |
| 11.  NR\_L1enh\_URLLC | 11-6 | PUSCH repetition Type A | 1. PUSCH transmission with Rel-15 behavior with or without slot aggregation.   • With slot aggregation, the number of repetitions can be dynamically indicated (as agreed for Rel-16).  • When dynamically indicated, the number of repetitions is jointly coded with SLIV in TDRA table, by adding an additional column for the number of repetitions in the TDRA table. | [5-17] | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-7 | UL cancelation scheme for self-carrier | 1. Supports group common DCI (i.e. DCI format 2\_4) for cancelation indication on the same DL CC as that scheduling PUSCH or SRS 2. UL cancelation for PUSCH  * Cancellation is applied to each PUSCH repetition individually in case of PUSCH repetitions  1. UL cancelation for SRS symbols that overlap with the cancelled symbols |  | Yes | N/A |  | Per FS  Per FS is selected because the FG is very demanding in UE processing, considering that this can be a UE with processing capability 1 but required to be able to cancel according to processing capability 2, and hence it is important to take into account the BC information for dimensioning purpose | N/A | N/A | N/A | More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b or 11-2 or 11-2a | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-7a | UL cancelation scheme for cross-carrier | 1. Supports group common DCI (i.e. DCI format 2\_4) for cancelation indication on a different DL CC than that scheduling PUSCH or SRS 2. UL cancelation for PUSCH  * Cancellation is applied to each PUSCH repetition individually in case of PUSCH repetitions  1. UL cancelation for SRS symbols that overlap with the cancelled symbols |  | Yes | N/A |  | Per FS  Per FS is selected because the FG is very demanding in UE processing, considering that this can be a UE with processing capability 1 but required to be able to cancel according to processing capability 2, and hence it is important to take into account the BC information for dimensioning purpose | N/A | N/A | N/A | More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b or 11-2 or 11-2a | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-7b | Independent cancellation of the overlapping PUSCHs in an intra-band UL CA | 1. For a UE indicating the capability of pa-PhaseDiscontinuityImpacts, and if the PUSCH on at least one serving cell is cancelled, the UE may cancel the (repetition of the) PUSCHs transmission on all other intra-band serving cell(s). The cancellation of the (repetition of the) PUSCH transmission on a the set of intra-band serving cell(s) includes all symbols from the earliest symbol that is overlapping with the first cancelled symbol of the PUSCH on the serving cell for which the DCI format 2\_4 is applicable to. | 6-23, 11-7 | Yes | N/A |  | Per band | N/A | N/A | N/A | If UE indicates 6-23 but does not support this FG, UE is not expected to be scheduled simultaneous PUSCHs on multiple carriers but receiving UL CI only for subset of carriers in intra-band carriers | Optional with capability signaling |
| 11.  NR\_L1enh\_URLLC | 11-8 | Enhanced UL power control scheme | 1. For DG-PUSCH, one bit (separately from SRI) in UL grant is used to indicate the P0 value if SRI is present in the UL grant, and 1 or 2 bits is used to indicate the P0 value if SRI is not present in the UL grant |  | Yes | N/A |  | Per UE | No | Yes  Note: Differentiation is from the perspective of the scheduled carrier | N/A |  | Optional with capability signaling |
| 11.  NR\_L1enh\_URLLC | 11-9 | Multiple active configured grant configurations for a BWP of a serving cell | 1. Supports up to 12 configured/active configured grant configurations in a BWP of a serving cell.   • Separate RRC parameters for different configured grant configurations  • Separate activation for different configured grant Type 2 configurations  • Separate release for different configured grant Type 2 configurations   1. Supported maximum number of configured/active configured grant configurations in a BWP of a serving cell   Candidate values for component 2: {1, 2, 4, 8, 12}   1. Supported maximum number of configured/active configured grant configurations across all serving cells   Candidate values for component 3: {2, …, 32} | One of {5-19, 5-20} | Yes | N/A |  | [Per UE]  FFS: FSPC | [No] | [No] | [N/A] | For component 3: Total number in FR1 is not greater than X value reported for FR1. Total number in FR2 is not greater than X value reported for FR2.Total number across FR1 and FR2 is not greater than the larger of the FR1 and FR2 values | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-9a | Joint release in a DCI for two or more configured grant Type 2 configurations for a given BWP of a serving cell | 1. M<=4 bits indication in the Release DCI is used for indicating which CG configuration(s) is/are released, where the association between each state indicated by the indication and the CG configuration(s) is   • Up to 2^M states are higher layer configurable, where each of the state can be mapped to a single or multiple CG configurations to be released  • In case of no higher layer configured state(s), separate release is used where the release corresponds to the CG configuration index indicated by the indication | 11-9 | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-10 | Type 2 configured grant release by DCI format 0\_1 | 1. Support of type 2 configured grant release by DCI format 0\_1 | 5-20 | Yes | N/A |  | Per UE | No | No | N/A | A UE supporting this feature and 11-1 (DCI format 0\_2/1\_2) shall also support 11-11 (Type 2 configured grant release by DCI format 0\_2). | Optional with capability signalling |
| 11.  NR\_L1enh\_URLLC | 11-11 | Type 2 configured grant release by DCI format 0\_2 | 1. Support of type 2 configured grant release by DCI format 0\_2 | 5-20, 11-1 | Yes | N/A |  | Per UE | No | No | N/A | A UE supporting this feature shall also support 11-10 (Type 2 configured grant release by DCI format 0\_1). | Optional with capability signalling |

1. NR\_IIOT

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 12. NR\_IIOT | 12-1 | UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer | Support intra-UE multiplexing/prioritization of overlapping PUCCH/PUCCH and PUCCH/PUSCH with two priority levels in physical layer (PHY)   1. [Configuration of PHY priority level for CG PUSCH and SR, and dynamic indication of priority level for dynamic PUSCH with a single DCI format] 2. Multiplexing/prioritization between UL channels/signals with the same PHY priority level 3. Prioritization between UL channels/signals with different PHY priority levels 4. Additional number of symbols (d1) needed beyond the PUSCH preparation time for cancelling a low priority UL transmission. 5. Additional number of symbols (d2) needed beyond the PUSCH preparation time for scheduling a high priority UL transmission that cancels a low priority UL transmission | [11-4] | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] | Candidate value set for component 4: {0, 1, 2}  Candidate value set for component 5: {0, 1, 2}  [A UE supporting this feature shall also support the LCP restriction based on DCI priority indication ([*lch-ToGrantPriorityRestriction-r16*]) and intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*]).]  The relationship between this feature and the feature of up to two HARQ-ACK codebooks of 11-4 and 11-4xshould be further discussed. | Optional with capability signaling |
| 12. NR\_IIOT | 12-1a | UL priority indication in DCI with mixed DCI formats | Support of priority indicator field configured in DCI formats 0\_1 and 0\_2 in a BWP when configured to monitor both DCI formats 0\_1 and 0\_2 in the BWP | 12-1 and 11-1 | Yes | N/A |  | Per UE | No | No | N/A |  | Optional with capability signalling |
| 12. NR\_IIOT | 12-2 | Multiple SPS configurations | 1. Support of up to 8 configured SPS configurations in a BWP of a serving cell and up to 32 configured SPS configurations in a cell group, including separate RRC parameters and separate activation/release for different SPS configurations 2. The max number of active SPS configurations in a BWP of a serving cell 3. The max number of active SPS configurations across all serving cells 4. The related HARQ-ACK enhancements to support multiple active SPS configurations | 5-18 DL SPS | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] | Component-2, candidate value set is {1, 2, …, 8}  Component-3, candidate value set is [{2, …, 32}] | Optional with capability signaling |
| 12. NR\_IIOT | 12-2a | Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell | 1. M<=4 bits indication in the Release DCI is used for indicating which SPS configuration(s) is/are released, where the association between each state indicated by the indication and the SPS configuration(s) is   • Up to 2^M states are higher layer configurable, where each of the state can be mapped to a single or multiple SPS configurations to be released  • In case of no higher layer configured state(s), separate release is used where the release corresponds to the SPS configuration index indicated by the indication   1. The related HARQ-ACK enhancements to support joint release | 12-2 | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signaling |
| 12. NR\_IIOT | 12-3 | SPS release by DCI format 1\_1 | Support of SPS release by DCI format 1\_1 | 5-18 DL SPS | Yes | N/A |  | Per UE | No | No | N/A |  | Optional with capability signaling |
| 12. NR\_IIOT | 12-3a | SPS release by DCI format 1\_2 | Support of SPS release by DCI format 1\_2 | 5-18 DL SPS and 11-1 | Yes | N/A |  | Per UE | No | No | N/A |  | Optional with capability signaling |
| 12. NR\_IIOT | 12-5 | Configuration of aggregation factor per SPS configuration | Support of configurable PDSCH aggregation factor ({1, 2, 4, 8}) per DL SPS configuration | 5-18 DL SPS | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signaling |
| 12. NR\_IIOT | 12-6 | Support of SPS periodicity shorter than 10 ms | Support of SPS periodicity shorter than 10 ms | 5-18 DL SPS | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signalling |

1. NR positioning

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | 13-1 | Common DL PRS Processing Capability | 1. Maximum DL PRS bandwidth in MHz, which is supported and reported by UE.   a) FR1 bands: {5, 10, 20, 40, 50, 80, 100}  b) FR2 bands: {50, 100, 200, 400}   1. DL PRS buffering capability: Type 1 or Type 2 2. Type 1 – sub-slot/symbol level buffering 3. Type 2 – slot level buffering 4. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE. 5. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms 6. N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms 7. Max number of DL PRS resources that UE can process in a slot under it    1. FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz    2. FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz   Note: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) of no more than 30%. |  | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported.  Notes for component 3:  a.UE reports one combination of (N, T) values per band, where N is a duration of DL PRS symbols in ms processed every T ms for a given maximum bandwidth (B) in MHz supported by UE  b.UE is not expected to support DL PRS bandwidth that exceeds the reported DL PRS bandwidth value  c.UE DL PRS processing capability is defined for a single positioning frequency layer. UE capability for simultaneous DL PRS processing across positioning frequency layers is not supported in Rel.16 (i.e. for a UE supporting multiple positioning frequency layers, a UE is expected to process one frequency layer at a time)  d.UE DL PRS processing capability is agnostic to DL PRS comb factor configuration  e.The reporting of (N, T) values for maximum BW in MHz is not dependent on SCS | Optional with capability signaling |
| 13. NR Positioning | 13-1a | Max number of positioning frequency layers UE supports across all positioning methods across all bands | Max number of positioning frequency layers UE supports across all positioning methods across all bands  Values: {1, 2, 3, 4} |  | No | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-2 | DL PRS Resources for DL AoD | 1. Max number of DL PRS Resource Sets per TRP per frequency layer supported by UE.   Values = {1, 2}   1. Max number of TRPs across all positioning frequency layers per UE.   Values = {4, 6, 12, 16, 24, 32, 64, 128, 256}   1. Max number of positioning frequency layers UE supports   Values = {1, 2, 3, 4} | 13-1 | No | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-2a | DL PRS Resources for DL AoD on a band | 1. Max number of DL PRS Resources per DL PRS Resource Set   Values = {2, 4, 8, 16, 32, 64}  Note: 16, 32, 64 are only applicable to FR2 bands   1. Max number of DL PRS Resources per positioning frequency layer.   Values = {6, 24, 32, 64, 96, 128, 256, 512, 1024}  Note: 6 is only applicable to FR1 bands | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-2b | DL PRS Resources for DL AoD on a band combination | 1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR1-only.   Values = {6, 24, 64, 128, 192, 256, 512, 1024, 2048}  Note this is reported for FR1 only BC.   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR2-only.   Values = {24, 64, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for FR2 only BC   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR1 in FR1/FR2 mixed operation.   Values = {6, 24, 64, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR2 in FR1/FR2 mixed operation.   Values = {24, 64, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands | 13-1 | No | N/A |  | Per BC | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-3 | DL PRS Resources for DL-TDOA | 1. Max number of DL PRS Resource Sets per TRP per frequency layer supported by UE.   Values = {1, 2}   1. Max number of TRPs across all positioning frequency layers per UE.   Values = {4, 6, 12, 16, 24, 32, 64, 128, 256}   1. Max number of positioning frequency layers UE supports   Values = {1, 2, 3, 4} | 13-1 | No | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-3a | DL PRS Resources for DL-TDOA on a band | 1. Max number of DL PRS Resources per DL PRS Resource Set   Values = {1, 2, 4, 8, 16, 32, 64}  Note: 16, 32, 64 are only applicable to FR2 bands   1. Max number of DL PRS Resources per positioning frequency layer.   Values = {6, 24, 32, 64, 96, 128, 256, 512, 1024}  Note: 6 is only applicable to FR1 bands | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-3b | DL PRS Resources for DL-TDOA on a band combination | 1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR1-only.   Values = {6, 24, 64, 128, 192, 256, 512, 1024, 2048}  Note this is reported for FR1 only BC.   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR2-only.   Values = {24, 64, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for FR2 only BC   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR1 in FR1/FR2 mixed operation.   Values = {6, 24, 64, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR2 in FR1/FR2 mixed operation.   Values = {24, 64, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands | 13-1 | No | N/A |  | Per BC | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-4 | DL PRS Resources for Multi-RTT | 1. Max number of DL PRS Resource Sets per TRP per frequency layer supported by UE.   Values = {1, 2}   1. Max number of TRPs across all positioning frequency layers per UE.   Values = {4, 6, 12, 16, 24, 32, 64, 128, 256}   1. Max number of positioning frequency layers UE supports   Values = {1, 2, 3, 4} | 13-1 | No | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-4a | DL PRS Resources for Multi-RTT on a band | 1. Max number of DL PRS Resources per DL PRS Resource Set   Values = {1, 2, 4, 8, 16, 32, 64}  Note: 16, 32, 64 are only applicable to FR2 bands   1. Max number of DL PRS Resources per positioning frequency layer.   Values = {6, 24, 32, 64, 96, 128, 256, 512, 1024}  Note: 6 is only applicable to FR1 bands | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-4b | DL PRS Resources for Multi-RTT on a band combination | 1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR1-only.   Values = {6, 24, 64, 128, 192, 256, 512, 1024, 2048}  Note this is reported for FR1 only BC.   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR2-only.   Values = {24, 64, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for FR2 only BC   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR1 in FR1/FR2 mixed operation.   Values = {6, 24, 64, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands   1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets for FR2 in FR1/FR2 mixed operation.   Values = {24, 64, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands | 13-1 | No | N/A |  | Per BC | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-5 | DL PRS Measurement Report for DL-AoD | 1. Max number of DL PRS RSRP measurements on different PRS resources from the same TRP supported by the UE   Values = {1, 2, 3, 4, 5, 6, 7, 8} | 13-2, | No | N/A |  | Per UE | No | Yes | N/A | Need for location server to know if the feature is supported.  the number of RSRP measurement on a particular band is also upper bounded by the number of resources per set supported by UE reported per band | Optional with capability signaling |
| 13. NR Positioning | 13-6 | DL PRS Measurement Report for DL-TDOA | 1. [DL RSTD measurements per pair of TRPs. Values = {1, 2, 3, 4}] 2. [Support RSRP measurements. Values = {0, 1}] | 13-3 | No | N/A |  | Per UE | No | Yes | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-7 | Support of SSB from neighbor cell as QCL source of a DL PRS | 1. Support of SSB from neighbor cell as QCL source of a DL PRS    * Support of reuse SSB measurement from RRM for receiving PRS   Note: Refers to Type-C for FR1 and Type-C & Type-D support for FR2 | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-7a | Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS | 1. [Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS]   Note: Refers to Type-D support for FR2 | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported.  DL PRSs are in the same band | Optional with capability signaling |
| 13. NR Positioning | 13-8 | SRS Resources for Positioning | 1. Max number of SRS Resource Sets for positioning supported by UE per BWP.   Values = {1, 2, 4, 8, 12, 16}.   1. Max number of P/SP/AP SRS Resources for positioning per BWP.   Values = {1,2,4,8,16,32,64}   1. Max number of P/SP/AP SRS Resources including the SRS resources for positioning per BWP per slot.   Values = {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}   1. Max number of periodic SRS Resources for positioning per BWP.   Values = {1,2,4,8,16,32,64}   1. Max number of periodic SRS Resources for positioning per BWP per slot.   Values = {1,2,3,4,5,6,8,10,12,14} |  | Yes | N/A |  | Per FS  Note: Per FS is selected because similar capability was reported per FS (in FeatureSetUplink) in Rel-15 | N/A | N/A | N/A | OLPC for SRS for positioning based on SSB from serving cell is part of FG13-8 | Optional with capability signaling |
| 13. NR Positioning | 13-8a | Support of Aperiodic SRS Resources for positioning | 1. Max number of aperiodic SRS Resources for positioning per BWP.   Values = {1,2,4,8,16,32,64}   1. Max number of aperiodic SRS Resources for positioning per BWP per slot.   Values = {1,2,3,4,5,6,8,10,12,14} | 13-8 | Yes | N/A |  | Per FS  Note: Per FS is selected because similar capability was reported per FS (in FeatureSetUplink) in Rel-15 | N/A | N/A | N/A |  | Optional with capability signaling |
| 13. NR Positioning | 13-8b | Support of Semi-persistent SRS Resources for positioning | 1. Max number of semi-persistent SRS Resources for positioning supported by UE per BWP.   Values = {1,2,4,8,16,32,64}   1. Max number of semi-persistent SRS Resources for positioning supported by UE per BWP per slot.   Values = {1,2,3,4,5,6,8,10,12,14} | 13-8 | Yes | N/A |  | Per FS  Note: Per FS is selected because similar capability was reported per FS (in FeatureSetUplink) in Rel-15 | N/A | N/A | N/A |  | Optional with capability signaling |
| 13. NR Positioning | 13-9 | OLPC for SRS for positioning based on PRS from the serving cell | 1. OLPC for SRS for positioning based on PRS from the serving cell in the same band | 13-1 and 13-8 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported (FFS for RAN2) | Optional with capability signaling |
| 13. NR Positioning | 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells | 1. OLPC for SRS for positioning based on SSB from neighbouring cells in the same band | 13-8 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported (FFS for RAN2) | Optional with capability signaling |
| 13. NR Positioning | 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells | 1. OLPC for SRS for positioning based on PRS from the neighbouring cells in the same band | 13-9 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported (FFS for RAN2) | Optional with capability signaling |
| 13. NR Positioning | 13-9e | PathLoss estimate maintenance per serving cell | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions”    * Candidate values are {1, 4, 8, 16}    * Note: SRS in “PUSCH/PUCCH/SRS” refers to SRS configured by SRS-Resource | One of {13-9, 13-9a, 13-9b, 13-9c} | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported (FFS for RAN2)  SRS and SSB and/or PRS are in the same band | Optional with capability signaling |
| 13. NR Positioning | 13-9f | PathLoss estimate maintenance across all cells | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions”    * Candidate values are {1, 4, 8, 16}    * Note: SRS in “PUSCH/PUCCH/SRS” refers to SRS configured by SRS-Resource | One of {13-9, 13-9a, 13-9b, 13-9c} | Yes | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported (FFS for RAN2)  SRS and SSB and/or PRS are in the same band | Optional with capability signaling |
| 13. NR Positioning | 13-10 | Spatial relation for SRS for positioning based on SSB from the serving cell | 1. Spatial relation for SRS for positioning based on SSB from the serving cell in the same band | 13-8 | Yes | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10a | Spatial relation for SRS for positioning based on CSI-RS from the serving cell | 1. Spatial relation for SRS for positioning based on CSI-RS from the serving cell in the same band | 13-10 | Yes | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10b | Spatial relation for SRS for positioning based on PRS from the serving cell | 1. Spatial relation for SRS for positioning based on PRS from the serving cell in the same band | One of  {13-2, 13-3, 13-4} and13-8 | Yes | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10c | Spatial relation for SRS for positioning based on SRS | 1. Spatial relation for SRS for positioning based on SRS in the same band | 13-8, | Yes | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10d | Spatial relation for SRS for positioning based on SSB from the neighbouring cell | 1. Spatial relation for SRS for positioning based on SSB from the neighbouring cell in the same band | 13-10 | Yes | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10e | Spatial relation for SRS for positioning based on PRS from the neighbouring cell | 1. Spatial relation for SRS for positioning based on PRS from the neighbouring cell in the same band | 13-10b | Yes | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10f | Spatial relation maintenance | 1. Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.   Values = {0,1,2,4,8,16}]  Note: component 1 is for all cells across all bands  Note: SRS in “PUSCH/PUCCH/SRS” refers to SRS configured by SRS-Resource | One of {13-10, 13-10a, 13-10b, 13-10d, 13-10e} | Yes | N/A |  | Per UE | No | No (FR2 only) | N/A | Need for location server to know if the feature is supported.  SRS and SSB and/or PRS are in the same band | Optional with capability signaling |
| 13. NR Positioning | 13-11a | SRS-PRS association for Multi-RTT | 1. Support of measurements derived on one or more DL PRS resource/resource sets which may be in different positioning frequency layers for SRS transmitted in a single CC.   Note: PRS and SRS may be in a different band | 13-4 and 13-8 | No | N/A |  | TBD | TBD | TBD | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-11 | UE Rx-Tx Measurement Report for Multi-RTT | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.   Value for component 1: {1,2,3,4}  Note: DL PRS resource/sets are on the same frequency layer  Note: the number of UE Rx – Tx time difference measurements refers to the measurements for a single TRP   1. Support RSRP measurements. Values = {0, 1}   Note: If the UE reports value 1 for component 2, same number of RSRP measurements supported as UE Rx-Tx measurements for component 1 | 13-4 and 13-8 | No | N/A |  | Per UE | No | Yes | N/A | Need for location server to know if the feature is supported.  FG13-11 covers the case that SRS and DL PRS are on the same band | Optional with capability signaling |
| 13. NR Positioning | 13-12 | NR E-CID DL SSB RRM measurements with LPP support for NR Positioning | 1. NR E-CID DL SSB RRM measurements with LPP support for NR Positioning | 1-1 | No | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-12a | NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning | 1. NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning | 1-4 | No | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-13 | Simultaneous DL-AoD and DL-TDoA processing | 1. Support of simultaneous processing for DL AoD and DL TDoA measurements   If it is not indicated, a UE is not expected to perform simultaneously the processing for deriving DL AoD and DL TDoA measurements | 13-2 and 13-3 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-14 | Simultaneous DL-AoD and Multi-RTT processing | 1. Support of simultaneous processing for DL AoD and Multi-RTT measurements   If it is not indicated, a UE is not expected to perform simultaneously the processing for deriving DL AoD and M-RTT measurements | 13-2, 13-4 and 13-8 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-15 | Simultaneous SRS transmission for intra-band CA | 1. The number of SRS resources for positioning on a symbol for intra-band CA   Candidate values {1, 2} | 13-8 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported (FFS for RAN2) | Optional with capability signaling |
| 13. NR Positioning | 13-15a | Simultaneous SRS transmission for inter-band CA | 1. The number of SRS resources for positioning on a symbol for inter-band CA   Candidate values {1, 2} | 13-8 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported (FFS for RAN2) | Optional with capability signaling |
| 13. NR Positioning | 13-18 | Support of parallel processing of LTE PRS and NR PRS | 1. Support of parallel processing of LTE PRS and NR PRS |  | No | N/A |  | Per UE | No | No | N/A | Need for location server to know if the feature is supported | Optional with capability signaling |

1. NR TEI

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 14. NR TEI | 14-1 | Multiple LTE-CRS rate matching patterns | 1. Maximum number of LTE-CRS rate matching patterns in total within a NR carrier using 15 kHz SCS 2. Maximum number of LTE-CRS non-overlapping rate matching patterns within a NR carrier using 15 kHz SCS | 5-28 (Rate-matching around LTE CRS) | Yes | N/A |  | Per band | N/A | N/A (FR1 only) | N/A | For DSS  The number of the additional CRS rate matching patterns reported in Rel-16 is accounted in the total number of rate matching pattern reported by the UE for Rel-15 by using pdsch-RE-MappingFR1-PerSymbol/pdsch-RE-MappingFR1-PerSlot and pdsch-RE-MappingFR1-PerSymbol/pdsch-RE-MappingFR1-PerSlot  UE reporting component 1 for 14-1 also reports component 2.  Reporting of values of Component 1 larger than two is only applicable when reporting values of Component 2 larger than one. | Optional with capability signalling  Component 1:{2, 3, 4, 5, 6}  Component 2: {1, 2, 3} |
| 14. NR TEI | 14-1a | Two LTE-CRS overlapping rate matching patterns within a part of NR carrier using 15 kHz overlapping with a LTE carrier | 1. Support of two LTE-CRS overlapping rate matching patterns within a part of NR carrier using 15 kHz SCS overlapping with a LTE carrier | 14-1 | Yes | N/A |  | Per band | N/A | N/A (FR1 only) | N/A | For DSS  The number of the additional CRS rate matching patterns reported in Rel-16 is accounted in the total number of rate matching pattern reported by the UE for Rel-15 by using pdsch-RE-MappingFR1-PerSymbol/pdsch-RE-MappingFR1-PerSlot and pdsch-RE-MappingFR1-PerSymbol/pdsch-RE-MappingFR1-PerSlot | Optional with capability signaling |
| 14. NR TEI | 14-2 | PDSCH Type B mapping of length 9 and 10 OFDM symbols | 1. support of PDSCH Type B scheduling of length 9 and 10 OFDM symbols 2. support of DMRS shift for length-10 symbols | 5-6a (PDSCH mapping type B) | Yes | N/A |  | Per band | N/A | N/A (FR1 only) | N/A | For DSS  FG10-8 covers PDSCH type B mapping without DMRS shift due to CRS collision. | Optional with capability signaling |
| 14. NR TEI | 14-3 | One slot periodic TRS configuration for FR1 | 1. UE can be configured with one-slot periodic TRS configuration only when no two consecutive slots are indicated as downlink slots by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigDedicated | 2-51 (CSI-RS for tracking) | Yes | N/A | No TRS can be configured when no two consecutive slots are indicated as downlink slots by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigDedicated | Per band | N/A (TDD only) | N/A (FR1 only) | N/A | UE can be configured with one-slot periodic TRS configuration only when no two consecutive slots are indicated as downlink slots by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigDedicated.  This FG is not also applicable for the case that all slots are indicated as flexible | Optional with capability signalling |
| 14. NR TEI | 14-4 | SRS Tx switch with allowing downgrading configuration | 1) Support SRS Tx port switch | 2-55 | Yes | N/A |  | Per BC (same reporting type as srs-TxSwitch in Rel-15) | N/A | N/A | N/A | Agreement:  •Rel-16 UE capability design for SRS antenna switching in conjunction with the existing Rel-15 UE capability should allow UE to indicate support of one of the following combinations  o{t1r1, t1r2}  o{t1r1, t1r2, t1r4}  o{t1r1, t1r2, t2r2, t2r4}  o{t1r1, t2r2}  o{t1r1, t2r2, t4r4}  o{t1r1, t1r2, t2r2, t1r4, t2r4}  oNote: Detailed signaling design is up to RAN2 | Optional with capability signalling  Component 1: Candidate value set:  {  o{t1r1, t1r2}  o{t1r1, t1r2, t1r4}  o{t1r1, t1r2, t2r2, t2r4}  o{t1r1, t2r2}  o{t1r1, t2r2, t4r4}  o{t1r1, t1r2, t2r2, t1r4, t2r4}  }  Component2: Candidate value set: {yes, no}  Component 3: Candidate value set: {yes, no} |
| 14. NR TEI | 14-5 | Half-duplex UE behaviour in TDD CA for same SCS | 1. Support for directional collision handling between reference and other cell(s) for half-duplex operation in CA with same SCS | 6-5 and simultaneousRxTxInterBandCA not supported | Yes | N/A |  | Per BC | N/A (TDD only) | N/A | N/A | Half duplex UEs that do not indicate this capability should still be able to operate half-duplex TDD CA (i.e. simultaneousRxTxInterBandCA not supported) per Rel15 specifications if network ensures same transmission direction across all the serving cells | Optional with capability signaling |
| 14. NR TEI | 14-6 | New RACH configuration for FR1 TDD | 1. new RACH configuration entries with subframe number 2 and/or 7 for RACH periodicity longer than 10 ms |  | No | N/A |  | N/A | N/A (TDD only) | N/A (FR1 only) | N/A | Agreement:  •A new UE capability is not introduced for this TEI, i.e., it is a mandatory UE feature for Rel-16. | Mandatory without capability signalling |
| 14. NR TEI | 14-7 | New capability for beamSwitchTiming values of 224 and 336 | 1. Indicates the minimum number of required OFDM symbols {224, 336} between the DCI triggering aperiodic CSI-RS and the corresponding aperiodic CSI-RS transmission in a CSI-RS resource set configured with repetition ‘ON’  * Candidate values: {224, 336} | 2-28 | Yes | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Agreements:  ・48 is used as the beam switching threshold for Ues reporting 224 or 336  ØWhen using the higher values of the feature (sym224 and sym336), beamSwitchTiming indicates the minimum number of OFDM symbols between the DCI triggering of aperiodic CSI-RS and aperiodic CSI-RS transmission in a CSI-RS resource configured with repetition ‘ON’ to apply TCI indication in CSI-RS triggering DCI. | Optional with capability signaling |
| 14. NR TEI | 14-8 | CSI trigger states containing non-active BWP | 1. CSI trigger states containing non-active BWP |  | Yes | N/A |  | Per UE | No | No | N/A | Agreements:  TEI – “CSI trigger states containing non-active BWP”  ・When a UE is triggered with a CSI report for a DL BWP that is non-active, the UE is not expected to report the CSI for the non-active BWP and the CSI report associated with the BWP is omitted.  ・When a UE is triggered with aperiodic CSI-RS in a DL BWP that is non-active, the UE is not expected to measure the aperiodic CSI-RS.  ・The above non-active BWP is the non-active BWP when receiving the associated CSI-RS with the following relaxation for UE processing.  In the CC of the associated CSI-RS, if the active BWP when receiving the CSI-RS is different from the active BWP when receiving the triggering DCI  The last symbol of the PDCCH span of the DCI carrying the BWP switching shall be no later than the last symbol of the PDCCH span of the CSI trigger DCI, irrespective of whether they are in the same CC or not and irrespective of whether they are in the same SCS or not.  The UE is not expected to have any other BWP switching in that CC after the last symbol of the PDCCH span covering CSI trigger DCI and before the first symbol of the triggered CSI-RS resource.  ・Note: the UE is not required to measure P/SP-CSI-RS in the non-active BWP per current specification | [Mandatory or Optional] with capability signaling |

1. 5G\_V2X\_NRSL

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 15-1 | Receiving NR sidelink | 1) UE can receive NR PSCCH/PSSCH. Up to [A] sidelink HARQ processes are supported.  2) UE can receive [X] PSCCH in a slot.  3) UE can attempt to decode [Y] RBs per slot  4) UE supports reception of PSSCH according to the 64QAM MCS table 5) UE supports PT-RS reception in FR2.  8) UE can receive using the subcarrier spacing and CP length defined for a given band in RAN4  10) Supports 14-symbol SL slot with all DMRS patterns corresponding to {#PSSCH symbols} = {12, 9} for slots w/wo PSFCH. If UE signals support of ECP, support 12-symbol SL slot with all DMRS patterns corresponding to {#PSSCH symbols} = {10,7} for slots w/wo PSFCH.  12) UE can receive using 30 kHz subcarrier spacing with normal CP in FR1, 120 kHz subcarrier spacing with normal CP FR2 | None | Yes | Yes |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 8 is not required to be signalled in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 12 is only required in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Component-1 candidate value set: ~~for A are~~ {value1, value2 …}  Component-2 candidate value set: {value1, value2, …}  FFS: whether to report different value for each SCS indicated in component-8  Component-3 candidate value set: {value1, value2, …}  FFS: whether to report different value for each SCS indicated in component-8  Component-8 candidate value set in FR1:  {{15 kHz}, {30 kHz}, {60 kHz}, {15, 30 kHz}, {30, 60 kHz}, {15, 60 kHz}, {15, 30, 60 kHz}}  Component-8 candidate value set in FR2:  {{60 kHz}, {120 kHz}, {60, 120 kHz}}  Component-8 candidate value set for CP length: {NCP,NCP and ECP}  (ECP only applies to SCS of 60 kHz) | Optional with capability signaling. For UE supports NR sidelink, UE must indicate this FG is supported. |
| 15-2 | Transmitting NR sidelink mode 1 scheduled by NR Uu | 1) UE can transmit PSCCH/PSSCH using dynamic scheduling or configured grant type 1 and 2 in NR sidelink mode 1 scheduled by NR Uu. Up to 8 configured grants can be configured for a UE. Up to [C] sidelink HARQ processes are supported including those for configured grants  2) UE can transmit PSSCH according to the normal 64QAM MCS OFDM table.  3) UE supports PT-RS transmission in FR2.  4) UE can monitor DCI format 3\_0 for NR sidelink dynamic scheduling and configured grant type 2.  6) UE can transmit using the subcarrier spacing and CP length it reports.  8) Supports 14-symbol SL slot with all DMRS patterns corresponding to {#PSSCH symbols} = {12, 9} for slots w/wo PSFCH. If UE signals support of ECP, support 12-symbol SL slot with all DMRS patterns corresponding to ~~{~~#PSSCH symbols} = {10,7} for slots w/wo PSFCH.  9) Support downlink pathloss based open loop power control  11) UE can report sidelink HARQ-ACK to gNB via PUCCH and PUSCH when it is operating in NR sidelink mode 1 |  | Yes | No |  | Per band | N.A. | N.A. | N.A. | Note: Random selection in the exceptional pool is supported.  FFS: This is the basic FG for sidelink in licensed spectrum where gNB is operating on or managing that spectrum and optional FG otherwise  Candidate values for C are {value1, value2 …}  Component-6 candidate value set in FR1:  {{15 kHz}, {30 kHz}, {60 kHz}, {15, 30 kHz}, {30, 60 kHz}, {15, 60 kHz}, {15, 30, 60 kHz}}  Component-6 candidate value set in FR2:  {{60 kHz}, {120 kHz}, {60, 120 kHz}}  Component-6 candidate value set for CP length: {NCP,NCP and ECP}  (ECP only applies to SCS of 60 kHz)  Note: For Component 6, if a band is not indicated with only the PC5 interface in 38.101-1 Table 5.2E-1, the reported numerology shall be the same for sidelink and uplink.  FFS: Component (9) is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 11 is not required to be supported in a band indicated with the PC5 interface in 38.101-1 Table 5.2E-1  FFS: whether to mandate an SCS. | Optional with capability signalling  FFS: For UE supports NR sidelink in licensed spectrum where gNB is defined, UE must indicate this FG is supported. |
| 15-3 | Transmitting NR sidelink mode 2 | 1) UE can transmit PSCCH/PSSCH using NR sidelink mode 2 configured by NR Uu or preconfiguration. Up to [B] sidelink processes are supported.  2) UE can transmit PSSCH according to the normal 64QAM MCS table.  3) UE supports PT-RS transmission in FR2.  4) UE can perform mode 2 sensing and resource allocation operations  6) UE can transmit using the subcarrier spacing and CP length it reports for FG 15-1  8) Supports 14-symbol SL slot with all DMRS patterns corresponding to {#PSSCH symbols} = {12, 9} for slots w/wo PSFCH. If UE signals support of ECP, support 12-symbol SL slot with all DMRS patterns corresponding to ~~{~~#PSSCH symbols} = {10,7} for slots w/wo PSFCH.  10) UE can transmit using 30 kHz and normal CP subcarrier spacing in FR1, 120 kHz subcarrier spacing with normal CP FR2  11) DL pathloss based open loop power control when mode 2 is configured by NR Uu | 15-1 | Yes | No |  | Per band | N.A. | N.A. | N.A. | Note: Random selection in the exceptional pool is supported.  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  This is the basic FG for sidelink [in ITS spectrum where gNB is not defined and optional FG for licensed spectrum where gNB is defined]  Candidate values for B are {FFS}  Note: Component 6 is not required to be signalled in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 10 is only required in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 11 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1 | Optional with capability signalling  For UE supports NR sidelink, [for UE supports NR sidelink in ITS spectrum where gNB is not defined, UE must indicate this FG is supported,] UE must indicate this FG is supported.  Candidate values for B are {value1, value2 …} |
| 15-4 | Synchronization sources for NR sidelink | 1) UE can receive S-SSB in NR sidelink if it supports 15-1.  2) UE can transmit S-SSB in NR sidelink if it supports 15-2 or 15-3.  3) UE supports GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to false.  4) UE can transmit or receive NR sidelink based on the synchronization to an gNB  5) UE additionally supports gNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to gnbEnb.  6) UE additionally supports gNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to true. | At least one of 15-1, 15-2, 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink.  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 4 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 5 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 6 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1 | Optional with capability signalling  For UE supports NR sidelink, UE must indicate this FG is supported. |
| 15-5 | Sidelink congestion control | 1) UE can report CBR measurement to gNB when operating in Mode 1 and mode 2  2) UE can adjust its radio parameters based on CBR measurement and CRlimit.  3) UE can process CBR and CR within the time it indicates | 15-1 and at least one of 15-2 and 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. | FFS: This is the basic FG for NR sidelink  Note: component 1 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Component-3 candidate value set  {Congestion process time 1, Congestion process time 2} where  Congestion process time 1: 2, 2, 4, 8 slots for 15, 30, 60, 120 kHz subcarrier spacing.  Congestion process time 2: 2, 4, 8, 16 slots for 15, 30, 60, 120 kHz subcarrier spacing | Optional with capability signalling  FFS: For UE supports NR sidelink, UE must indicate this FG is supported. |
| 15-6 | Short-term time-scale TDM for in-device coexistence | 1. Support prioritization between LTE sidelink transmission/reception and NR sidelink transmission/reception 2. FFS: Maximum time required for the inter-RAT conflict resolution is X | At least one of 15-1, 15-2, 15-3  UE supports LTE V2X sidelink | No | No | FFS | [Per band] | N.A. | N.A. | N.A. |  | Optional with capability signalling |
| 15-7 | Transmitting LTE sidelink mode 3 scheduled by NR Uu | 1) UE can be scheduled over NR Uu by DCI format 3\_1 for LTE sidelink mode 3 transmission..  2) UE reports a value ‘X’ for the minimum value it supports for the additional time indicated in the NR DCI scheduling LTE sidelink mode 3 | UE supports LTE V2X sidelink | Yes | No |  | Per band | N.A. | N.A. | N.A. | Component-2 candidate value set:  {0ms, 0.25ms, 0.5ms, 0.625ms, 0.75ms, 1ms, 1.25ms, 1.5ms,1.75ms, 2ms, 2.5ms, 3ms, 4ms, 5ms, 6ms, 8ms, 10ms, 20 ms } | Optional with capability signalling |
| 15-9 | Transmitting LTE sidelink mode 4 configured by NR Uu | 1) UE can be configured over NR Uu for LTE sidelink mode 4 operation | UE supports LTE V2X sidelink | Yes | No |  | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
| 15-10 | 256QAM sidelink transmission | 1) UE can transmit PSSCH according to the 256QAM MCS table | At least one of 15-2, 15-3 | Yes | Yes | UE does not support transmission according to the 256QAM MCS table | Per band | N.A. | N.A. | Note: RAN4 to decide |  | Optional with capability signalling |
| 15-11 | PSFCH format 0 | 1) UE can transmit and receive NR PSFCH format 0  2) UE can receive up to N PSFCH(s) resources in a slot.  3) UE can transmit up to M PSFCH(s) resources in a slot | At least one of 15-1, 15-3 | FFS | FFS |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink.  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1 | Optional with capability signalling  For UE supports NR sidelink, UE must indicate this FG is supported.  Candidate values for N are {5, 15, 25, 32, 35, 45, 50, 64}  Candidate values for M are {[1], 4, [5,] 8, 16} |
| 15-12 | Low-spectral efficiency 64QAM MCS table | 1) UE can transmit and receive PSSCH according to the low-spectral efficiency 64QAM MCS table. | At least one of 15-1, 15-2, 15-3 | Yes | Yes | UE does not support transmission/reception according to the low spectral-efficiency 64QAM MCS table | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
| 15-14 | Sidelink CSI report | 1) UE can transmit and receive sidelink CSI-RS with up to P antenna port(s).  2) UE supports RI and CQI feedback on sidelink. | 15-1 and at least one of 15-2 and 15-3 | No | Yes |  | Per band | N.A. | N.A. | N.A. | FFS: This is the basic FG for NR sidelink  Note: Component 1 candidate values are P = {1,2} | Optional with capability signalling.  FFS: For UE supports NR sidelink, UE must indicate this FG is supported. |
| 15-15 | eNB type synchronization source for NR sidelink | 1) UE can transmit or receive NR sidelink based on the synchronization to an eNB.  2) If UE supports 15-4, UE additionally supports eNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to gnbEnb.  3) If UE supports 15-4, UE additionally supports eNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to true. | At least one of 15-1, 15-2, 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling. |
| 15-16 | Simultaneous transmission of uplink and sidelink | 1) UE supports simultaneous transmission of NR uplink and NR sidelink (in different bands) in a band combination for which the UE indicated simultaneous sidelink and uplink support in a band combination. | At least one of 15-2 and 15-3 | Yes | No |  | Per band combination | N.A. | N.A. | N.A. |  | Optional with capability signalling. |
| 15-18 | Support of rank 2 transmission | 1) UE additionally supports rank 2 PSSCH transmission | [At least one of 15-2 and 15-3] | FFS | FFS | UE supports rank 1 PSSCH transmission only. | Per band | N.A. | N.A. | N.A. | This FG is a WA | Optional with capability signalling |
| 15-19 | Support of rank 2 reception | 1) UE additionally supports rank 2 PSSCH reception | [15-1] | FFS | FFS | UE supports rank 1 PSSCH reception only. | Per band | N.A. | N.A. | N.A. | This FG is a WA.  FFS: This is the basic FG for NR sidelink | [Optional with capability signalling] |
| 15-22 | Support of fewer than 14 consecutive sidelink symbols in a slot | 1. UE additionally supports transmission/reception of SL slot configured with 7, 8, 9, 10, 11, 12, 13 consecutive symbols [and the corresponding DMRS patterns it reports.] 2. [UE supports [some/all] applicable DMRS patterns for the number of consecutive Sl symbols it reports] | At least one of 15-1, 15-2, 15-3 | Yes | No | UE supports SL only in a SL slot configured with 14 consecutive symbols. | Per band | N.A. | N/A | N.A. | FFS: This is the basic FG for NR sidelink  [Note: For Component (1) the support of 12 symbols is mandatory for ECP]  [The component-1 candidate value set can be DRMS patterns corresponding to {#PSSCH symbols, #DMRS symbols} = {{12,2},{12,1}, {11,4},{11,3},{11,2}, {10,4},{10,3},{10,2}, {9,2},[{9,3},] {8,3},{8,2},{7,2},{6,2}, {5,2}}] | Optional with capability signalling |
| 15-23 | Support of open loop SL power control and RSRP report | 1. Support sidelink pathloss based open loop power control and RSRP report in case of unicast | 15-1 and at least one of 15-2 and 15-3 | FFS | Yes |  | Per band | N.A. | N/A | N.A. | Working assumption: This FG is a basic UE FG [at least] for UEs supporting mode 1  FFS: whether this is a basic FG also for UEs not supporting mode 1 | Optional with capability signalling |
| 15-24 | [Support of multiple synchronization references] | [1) UE can support sidelink reception using up to A synchronziaion references in a carrier/BWP] | At least one of 15-1, 15-2, 15-3 | Yes | No | UE supports only a single synchronization reference in a carrier/BWP. | Per band | N.A. | N.A. | N.A. | Component-1 candidate value set: {1, 2, 3, 4}  Note: RAN1 is still discussing whether this FG is needed | Optional with capability signalling |

1. NR\_eMIMO

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
|  | 16-1a-1 | SSB/CSI-RS for L1-SINR measurement | Per slot limitations:   1. The max number of [unique] SSB/CSI-RS [(1Tx)] for CMR 2. The max number of [CSI-IM/NZP-IMR] resources 3. [The max number of CSI-RS (2Tx) resources for CMR]   Memory limitations:   1. The max number of SSB/CSI-RS ~~(1Tx)/CSI-IM~~ resources as CMR 2. The max number of [CSI-IM/NZP IMR] resources   Other limitations:   1. [Supported density of CSI-RS (CMR)] 2. The max number of aperiodic CSI-RS resources across all CCs configured to measure L1-SINR (including CMR and IMR) shall not exceed MD\_1 3. Supported SINR measurements: {SSB as CMR with dedicated IMR, CSI-RS as CMR with dedicated [CSI-IM/NZP IMR] configured, CSI-RS as CMR without dedicated IMR configured[, CMR+CSI-IM+NZP-IMR], [CSI-RS (2Tx) resources for CMR]} | 2-21, 2-22 or 2-23, 2-23a |  |  |  | Per band |  |  |  | Note: For Component 11, UE must at least report support of one [FFS: which one(s)]  FFS: How CSI-RS is counted when it is configured as CMR without dedicated IMR | Optional with capability signalling |
| 16-1a-2 | Non-group based L1-SINR reporting | 1. Support of non-group based L1-SINR reporting with N\_max L1-SINR values reported | 16-1a-1 |  |  |  | Per band | No | No |  | Note: Default value is N\_max = 1 in case 16-1a-2 is not provided by the UE. | Optional with capability signalling  Candidate value set is {1, 2, 4} |
| 16-1a-3 | Group based L1-SINR reporting | 1. Support of group based L1-SINR reporting | 16-1a-1 |  |  |  | Per band | No | No |  |  | Optional with capability signalling |
| 16-1b-1 | TCI state activation across multiple CCs | 1. Support of Simultaneous TCI state activation across multiple CCs: PDCCH, PDSCH | Component 1: 2-1, 2-4 |  | N/A |  | per UE | No | Yes |  | Note: Whether a FG to indicate group(s) of bands that share the same DL spatial filters will be introduced is in RAN4 domain | Optional with capability signaling |
| 16-1b-2 | Spatial relation update across multiple CCs | 1. Support of Simultaneous spatial relation update across multiple CCs: AP-SRS, SP-SRS | Component 1: 2-59, 2-60 |  | N/A |  | per UE | No | Yes |  | Note: Whether a FG to indicate group(s) of bands that share the same UL spatial filters will be introduced is in RAN4 domain | Optional with capability signaling |
| 16-1b-3 | Spatial relation update for PUCCH group | 1. Support of PUCCH resource groups per BWP for simultaneous spatial relation update | 2-53, 2-59, 4-24 |  | N/A |  | [Per BC or per band] | No | Yes |  |  | Optional with capability signalling |
| 16-1c | Default spatial relation | Support of default spatial relation and pathloss reference RS for dedicated-PUCCH/SRS and PUSCH | 2-53, 2-59 |  | N/A |  | per UE | ~~[~~No~~]~~ | FR2 only |  |  | Optional with capability signaling |
| 16-1d | MAC CE spatial relation update for AP-SRS | Support of spatial relation update for AP-SRS via MAC CE | 2-53, 2-59 |  | N/A |  | Per UE | No | FR2 only |  |  | Optional with capability signalling |
| 16-1e | Pathloss reference RS activation via MAC CE | 1. The maximum number of configured pathloss reference RSs for PUSCH/PUCCH/SRS by RRC for MAC-CE based pathloss reference RS update | 8-3 |  | N/A |  | Per UE | No | No |  | Candidate values for component (1): {FFS} | Optional with capability signaling |
| 16-1f | SCell beam failure recovery | 1. The maximum number of SCells configured for SCell beam failure recovery simultaneously | 2-31 |  | N/A |  | TBD | N |  |  |  | Optional with capability signaling |
| 16-1g | Resources for beam management, [pathloss measurement, BFD, and BFR] | 1. The maximum number of [unique] SSB/CSI-RS/CSI-IM resources configured to measure within a slot across all CCs for any of L1-RSRP measurement, L1-SINR measurement, [pathloss measurement, BFD, RLM] and new beam identification 2. 5. The maximum number of SSB/CSI-RS/CSI-IM resources configured across all CCs for any of L1-RSRP measurement, L1-SINR measurement, [pathloss measurement, BFD, RLM] and new beam identification | 2-24, 2-31 |  | N/A |  | [Per band]  [Per BC]  [Per UE] | No | FFS |  | Component-1: candidate value set is {4, 8, 16, 32, 64, 128, FFS} | Optional with capability signaling |
| 16-2a | Multi-DCI based multi-TRP | 1. The maximum number of CORESETs configured per “PDCCH-Config” 2. The maximum number of CORESETs configured per CORESETPoolIndex ( if CORESETPoolIndex is not configured, it is assumed CORESETPoolIndex = 0) per “PDCCH-Config” 3. Support fully/partially overlapping PDSCHs in time and non-overlapping in frequency 4. Maximum number of unicast PDSCHs per CORESETPoolIndex per slot 5. [PDSCH processing capability for CC] | FFS |  | N/A |  | [per band / per FSPC] | No | FFS |  | Note: A UE may assume that its maximum receive timing difference between the DL transmissions from two TRPs is within a CP  FFS: component (4) only applies to UE processing capability #1 | FFS |
| 16-2a-0 | Overlapping PDSCHs in time and fully overlapping in frequency and time | 1. Support PDSCHs with fully overlapping REs, i.e. the allocated REs for PDSCH scheduled by DCI in CORESET configured with CORESETPoolIndex = 0 and PDSCH scheduled by DCI in CORESET configured with CORESETPoolIndex = 1 are exactly the same REs |  |  |  |  |  |  |  |  | Note: A UE may assume that its maximum receive timing difference between the DL transmissions from two TRPs is within a CP |  |
| 16-2a-1 | Overlapping PDSCHs in time and partially overlapping in frequency | 1. Support PDSCHs with partially[/fully] overlapping REs [in frequency], i.e. the allocated REs for PDSCH scheduled by DCI in CORESET configured with CORESETPoolIndex = 0 and PDSCH scheduled by DCI in CORESET configured with CORESETPoolIndex = 1 are partially overlapped, with at least one RE 2. FFS: Restrictions on the maximum number of MIMO layers of each scheduled PDSCH [if  PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain] 3. [The maximal number of PDSCH scrambling sequences per serving cell]   FFS whether default values of component 3/4 to be included in 16-2a |  |  |  |  |  |  |  |  |  |  |
| 16-2a-2 | Out-of-order operation for DL | 1. Support out-of-order operation for PDCCH to PDSCH  2. Support out-of-order operation for PDSCH to HARQ-ACK |  |  |  |  |  |  |  |  |  |  |
| 16-2a-3 | Out-of-order operation for UL | 1. Support out-of-order operation for PDCCH to PUSCH |  |  |  |  |  |  |  |  | Note: “Same closed loop index for power control across PUSCHs associated with different CORESETPoolIndex values is not supported by a UE indicating the support of this feature” |  |
| 16-2a-4 | HARQ-ACK for multi-DCI based multi-TRP - separate | 1. Support of separate HARQ-ACK 2. The maximum number of long PUCCHs within a slot for separate HARQ-Ack |  |  |  |  |  |  |  |  | ALT 1) Candidate values for Component 2:  {LongAndLong, LongAndShort, ShortAndShort}  ALT 2) Candidate values for Component 2: Supported combinations are   * short+short; * short+short and short+long   short+short, short+long, and long+long |  |
| 16-2a-4a | HARQ-ACK for multi-DCI based multi-TRP - joint | 1. Support of joint HARQ-ACK |  |  |  |  |  |  |  |  |  |  |
| 16-2a-5 | Separate CRS rate matching | Whether the UE can rate match around configured CRS patterns which is associated with CORESETPoolIndex  (if configured) and are applied to the PDSCH scheduled with a DCI detected on a CORESET with the same value of CORESETPoolIndex | FFS |  |  |  |  |  |  |  |  |  |
| 16-2a-6 | Default QCL enhancement for multi-DCI based multi-TRP | Support of default QCL assumption per CORESETPoolIndex |  |  |  |  |  |  |  |  | FR2 only |  |
| 16-2a-7 | Maximum number of activated TCI states | 1. The maximal number of activated TCI states per CORESETPoolIndex per BWP per CC including data and control 2. The maximal total number of activated TCI states across CORESETPoolIndex per BWP per CC including data and control   FFS whether default values to be included in 16-2a |  |  |  |  |  |  |  |  | Candidate values for Component 1: {1,2,4,8}  Candidate values for Component 2: {2,4,8,16} |  |
| 16-x | Simultaneous reception with different Type-D | Supports simultaneous reception with different Type-D [based on multiple spatial domain receiver filters]. This applies to [PDCCHs]/PDSCHs  FFS whether default values to be included in 16-2a |  |  |  |  |  |  |  |  |  |  |
| 16-2a-9 | [Simultaneous reception across CCs with Multi-DCI] | [The maximum number of CCs supporting multi-DCI based multi-TRP simultaneously] |  |  |  |  |  |  |  |  | Note: If the type of 16-2a is agreed to be FSPC or Fs this FG will be removed |  |
| 16-2a-10 | Value of BD factor | Value of R for BD/CCE  FFS whether default values to be included in 16-2a |  |  |  |  |  |  |  |  | Component: {1,2} |  |
| 16-2b-0 | Two default beams for single-DCI based multi-TRP | Support of default QCL assumption with two TCI states |  |  | N/A |  | Per band | N/A | FR2 only |  |  | Optional with capability signaling |
| 16-2b-1 | Single-DCI based SDM scheme | 1. Support of single-DCI based SDM scheme 2. FFS Support of DMRS entry {0, 2, 3} |  |  | N/A |  | [Per band or per FSPC] | N/A | N/A |  | [Candidate values for component (2): {0,2,3}] | Optional with capability signaling |
| 16-2b-1a | Downlink PTRS | 1. Support of 2-port DL PTRS |  |  | N/A |  | FFS | FFS | FFS |  |  | Optional with capability signaling |
| 16-2b-2 | Single-DCI based FDMSchemeA | Support of single-DCI based FDMSchemeA |  |  | N/A |  | [Per band or per FSPC] | No | No |  |  | Optional with capability signaling |
| 16-2b-3 | Single-DCI based FDMSchemeB | Support of single-DCI based FDMSchemeB |  |  | N/A |  | [per FSPC] | No | No |  |  | Optional with capability signaling |
| 16-2b-3a | Single-DCI based FDMSchemeB CW soft combining | 1. For FDMSchemeB, Support CW soft combining that UE can support |  |  | N/A |  | [per FSPC] | No | No |  |  | Optional with capability signaling |
| 16-2b-4 | Single-DCI based TDMSchemeA | 1. Support of single-DCI based TDMSchemeA 2. Supported maximum TBS size for TDMSchemeA |  |  | N/A |  | [Per band or per FSPC] | No | No |  | Component 2 candidate values {FFS} | Optional with capability signaling |
| 16-2b-5 | Single-DCI based inter-slot TDM | 1. Support of single-DCI based inter-slot TDM 2. Support of RepNumR16 in PDSCH-TimeDomainResourceAllocation and the maximum value of RepNumR16 3. Supported maximum TBS size [according to RepNumR16 in PDSCH-TimeDomainResourceAllocation] 4. [Maximum number of TCI states] |  |  | N/A |  | [Per band or per FSPC] | No | No |  | Component 2 candidate values: {FFS}  Component 3 candidate values {FFS} | Optional with capability signaling |
| 16-3a | Regular eType-II | Basic components:   1. {Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} to support regular eType-II for R=1 2. Support of parameter combinations 1-6 3. Support of rank 1,2 4. [Number of beams L per CSI-RS ports] | 2-35 | Yes | N/A |  | Per band and per BC | N/A | N/A |  |  | Optional with capability signaling |
| 16-3a-1 | Support of PMI sub-bands with R=2 | {Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} to support regular eType-II for R=2 | 16-3a | Yes | N/A | If this FG is not reported, UE does not support R=2 | Per band and per BC | N/A | N/A |  |  | Optional with capability signaling |
| 16-3a-2 | Support of parameter combinations 7-8 | Support of parameter combinations 7-8 | 16-3a | Yes | N/A | UE does not support parameter combination 7-8 | Per Band | N/A | N/A |  |  | Optional with capability signaling |
| 16-3a-3 | Support of rank 3,4 | Support of rank 3,4 | 16-3a | Yes | N/A | UE does not support rank 3-4 | Per Band | N/A | N/A |  |  | Optional with capability signaling |
| 16-3a-4 | CBSR | 1) CBSR with soft amplitude restriction | 16-3a | Yes | N/A | Only CBSR with hard amplitude restriction is supported | Per Band | N/A | N/A |  |  | Optional with capability signaling |
| 16-3b | Port selection eType-II | Basic components:   1. {Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} to support port selection eType-II for R=1 2. 6 parameter combinations (combos with L=6 don’t apply) 3. Support of rank 1,2 4. [Number of beams L per CSI-RS ports] | 2-35 | Yes | N/A |  | Per band and per BC | N/A | N/A |  |  | Optional with capability signaling |
| 16-3b-1 | Support of PMI sub-bands with R=2 | {Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} to support port selection eType-II for R=2 | 16-3b | Yes | N/A | UE does not support R=2 | Per band and per BC | N/A | N/A |  |  | Optional with capability signaling |
| 16-3b-2 | Support of rank 3,4 | Support of rank 3,4 | 16-3b | Yes | N/A | UE does not support rank 3-4 | Per Band | N/A | N/A |  |  | Optional with capability signaling |
| 16-4 | Low PAPR DMRS for DL | Low PAPR DMRS for PDSCH |  | Yes | N/A |  | Alt. 1) Per UE  Alt. 2) Per Band | Alt. 1) No  Alt. 2) N/A | Alt. 1) No  Alt. 2) N/A |  |  | [Optional with capability signaling] |
| 16-5a | UL full power transmission mode of *fullpower* | 1. Supported UL full power transmission mode of *fullpower* | 2-13, 2-14 | Yes | N/A |  | FFS: Per FS or Per band or Per band per BC | N/A | N/A |  |  | Optional with capability signaling |
| 16-5b | UL full power transmission [mode 1] | 1. Supported UL full power transmission [mode 1] 2. [Number of Tx to support mode 1: {2Tx, 4Tx, 2Tx\_4Tx}] | 2-13, 2-14 | Yes | N/A |  | Per FS | No | No |  |  | Optional with capability signaling |
| 16-5c | UL full power transmission mode 2 | 1. The maximum number of SRS resources in one SRS resource set with usage set to ‘codebook’ for Mode 2: {1, 2, 4} | 2-13, 2-14 | Yes | N/A |  | Per FS | No | No |  |  | Optional with capability signaling |
| 16-5c-2 | UL full power transmission mode 2 – SRS resources | 1. [Number of Tx to support mode 2: {2Tx, 4Tx, 2Tx\_4Tx}] 2. The SRS configuration with different number of antenna ports for Mode 2: {[NULL,] 1\_2, 1\_4, [2\_4], 1\_2\_4} | 16-5c | Yes | N/A |  | Per FS | No | No |  |  | Optional with capability signaling |
| 16-5c-3 | UL full power transmission mode 2 – fullpower TPMI groups | 1. TPMI group(s) which delivers full power: {2-port {2-bit bitmap}, 4-port non-coherent {G0~G3}, 4-port partial-coherent {G0~G6}, [FFS: 4-port full-coherent {G0~G6}]} | 16-5c | Yes | N/A |  | Per FS | No | No |  |  | Optional with capability signaling |
| 16-6a | Low PAPR DMRS for PUSCH without transform precoding | 1. For PUSCH without transform precoding |  | Yes | N/A |  | FFS: Per band | N/A | N/A |  |  | Optional with capability signalling |
| 16-6b | Low PAPR DMRS for PUCCH | For PUCCH format 3 and PUCCH format 4 with transform precoding and with pi/2 BPSK modulation | [FG 1-7, 4-4, 4-5] | Yes | N/A |  | FFS: Per band | N/A | N/A |  |  | Optional with capability signalling |
|  | 16-6c | Low PAPR DMRS for PUSCH with transform precoding and with pi/2 BPSK | For PUSCH with transform precoding and with pi/2 BPSK modulation | [1-6 and 2-12] | Yes | N/A |  | FFS: Per band | N/A | N/A |  |  | Optional with capability signalling |
| 16-7 | Extension of the maximum number of configured aperiodic CSI report settings | Extension of the maximum number of configured aperiodic CSI report settings for all codebook types | 2-32 | Yes | N/A |  | Per band | N/A | N/A |  |  | Optional with capability signaling |
| 16-8 | Active CSI-RS resources and ports for mixed codebook types in any slot | 1. Report a list of codebook combinations as {codebook 1, codebook 2} 2. For each codebook combination, report a list of {max number of ports per resource, max number of resources, max number of total ports} | [2-35] | Yes | N/A |  | per band and per BC | N/A | N/A |  | Component-1 candidate values:  Codebook 1 = {Type I SP, Type I MP}  codebook 2 = {Type II, Type II PS, eType II R=1, eType II R=2, eType II PS R=1, eType II PS R=2 }  FFS: whether introduce codebook 3, where codebook 3 is downselected from {Type II, Type II PS, eType II R=1, eType II R=2, eType II PS R=1, eType II PS R=2, NULL}  Note 3：if a UE reports one or more codebook combinations in 16-8, then usage of active CSI-RS resources and ports for multiple codebooks in any slot is allowed only within those combinations  Note 4: For coexisting of mixed codebooks in any slot, gNB need to honor 16-8 and per-codebook capability 2-36/40/41/43 and 16-3a/b  FFS: the max number of combinations can be signaled in component 1  FFS: the minimum requirement for component 2 | Optional with capability signaling |

1. NR\_CLI\_RIM

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 17. NR\_CLI\_RIM | 17-1 | CLI-RSSI measurement | 1. Support CLI-RSSI measurement. The max number of resources across all CCs configured to measure RSSI shall not exceed 64.  2. Maximum number of measurement resources configured for CLI-RSSI measurement |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {8, 16, 32, 64}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling |
| 17. NR\_CLI\_RIM | 17-2 | SRS-RSRP measurement | 1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement within a slot |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {4, 8, 16, 32}.  Candidate values for component 3 are {2, 4, 8}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling |
| 17. NR\_CLI\_RIM | 17-3 | Simultaneous reception of DL signals/channels and CLI-RSSI measurement resource | Support simultaneous reception of DL signals/channels and CLI-RSSI measurement resource | 17-1 | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | UE shall prioritize CLI-RSSI measurement when simultaneous reception of DL signals/channels and CLI-RSSI measurement resource is not supported.  How to capture this sentence is up to RAN2 | Optional with capability signalling |
| 17. NR\_CLI\_RIM | 17-4 | Simultaneous reception of DL signals/channels and SRS-RSRP measurement resource | Support simultaneous reception of DL signals/channels and SRS-RSRP measurement resource | 17-2 | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | UE shall prioritize SRS-RSRP measurement when simultaneous reception of DL signals/channels and SRS-RSRP measurement resource is not supported.  How to capture this sentence is up to RAN2 | Optional with capability signalling |

1. MR-DC/CA enhancement

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 18. MR-DC/CA enhancement | 18-1 | Basic UL power sharing for DC | Semi-static power sharing mode1 between MCG and SCG cells of same FR for NR dual connectivity. |  | Yes | N/A |  | Per BC | N/A | N/A | N/A | Absence means intra-FR DC is not supported. | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-1a | Semi-static UL power sharing mode 2 for DC | Semi-static power sharing mode 2 between MCG and SCG cells of same FR for NR dual connectivity. | 18-1 | Yes | N/A |  | Per BC | N/A | N/A | N/A | Semi-static power sharing mode 2 between MCG and SCG cells of same FR is applicable only for synchronous NR dual connectivity | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-1b | Dynamic UL power sharing for DC | Dynamic power sharing between MCG and SCG cells of same FR for NR dual connectivity.   1. T\_offset | 18-1 | Yes | N/A |  | Per BC | N/A | N/A | N/A | 1) {short, long} | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-4 | SCell dormancy indication within active time | Support for SCell dormancy indication sent within the active time on PCell with DCI format 0\_1/1\_1 | 6-5 | Yes | N/A |  | Per BC | N/A | N/A | N/A | One dormant BWP and one non-dormant BWP is supported per carrier  More than one non-dormant BWP per carrier is supported only if UE feature 6-3/6-4 is also supported | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-4a | SCell dormancy indication outside active time | Support for SCell dormancy indication sent outside the active time on PCell with DCI format 2\_6 | 19-1 | Yes | N/A |  | Per BC | N/A | N/A | N/A | One dormant BWP and one non-dormant BWP is supported per carrier  More than one non-dormant BWP per carrier is supported only if UE feature 6-3/6-4 is also supported | Optional with capability signalling |
| 18. MR-DC/CA enhancement | [18-4b] | [Support of SCell dormancy indication without data scheduling within active time] | [Support of SCell dormancy indication without data scheduling within active time] | TBD | Yes | N/A |  | FFS [Per UE or Per BC] | No | [Yes or N/A] | N/A |  | Optional with capability signaling |
| 18. MR-DC/CA enhancement | 18-5 | DL cross-carrier scheduling with different SCS | 1. The UE supports DL cross carrier scheduling for the different numerologies with carrier indicator field (CIF) in DL carrier aggregation where numerologies for the scheduling cell and scheduled cell are different  {Scheduling cell of lower SCS and scheduled cell of higher SCS, Scheduling cell of higher SCS and scheduled cell of lower SCS, both}  [2. Processing up to X unicast DCI scheduling for DL per scheduled CC ]  X is based on pair of (scheduling CC SCS, scheduled CC SCS):  X=[4] for (15,120), (15,60), (30,120),  X=[2] for (15,30), (30,60), (60,120 kHz),  X applies per span in a slot of scheduling CC | 6-5 | Yes | N/A |  | Per BC | N/A | N/A | N/A | crossCarrierScheduling-OtherSCS    Note: This applies also to the case where there is a single span in the slot for the scheduling CC.  In case UE supports 3-5b, the limits apply for each span for FDD scheduling cell and TDD scheduling cell. | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-5a | Default QCL assumption for cross-carrier scheduling | Indicates whether the UE can be configured with enabledDefaultBeamForCCS for default QCL assumption for cross-carrier scheduling for same/different numerologies | one of {6-10, 18-5} | Yes | N/A |  | Per BC | N/A | N/A | N/A |  | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-5b | UL cross-carrier scheduling with different SCS | 1. The UE supports UL cross carrier scheduling for the different numerologies with carrier indicator field (CIF) in UL carrier aggregation where numerologies for the scheduling cell and scheduled cell are different  {Scheduling cell of lower SCS and scheduled cell of higher SCS, Scheduling cell of higher SCS and scheduled cell of lower SCS, both}  [2. Processing up to X unicast DCI scheduling for UL per scheduled CC ]  X is based on pair of (scheduling CC SCS, scheduled CC SCS):  X=[4] for (15,120), (15,60), (30,120),  X=[2] for (15,30), (30,60), (60,120 kHz),  X applies per span in a slot of scheduling CC | 6-6 | Yes | N/A |  | Per BC | N/A | N/A | N/A | crossCarrierScheduling-OtherSCS    Note: This applies also to the case where there is a single span in the slot for the scheduling CC.  In case UE supports 3-5b, the limits apply for each span for FDD scheduling cell and TDD scheduling cell. | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-6 | Cross-carrier A-CSI RS triggering with different SCS | Cross-carrier A-CSI RS triggering with different SCS | 2-33 and 6-5 | Yes | N/A |  | Per BC | N/A | N/A | N/A | 1) {PDCCH cell of lower SCS and A-CSI RS cell of higher SCS, PDCCH cell of higher SCS and A-CSI-RS of lower SCS, both} . | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-6a | Default QCL assumption for cross-carrier A-CSI-RS triggering | Indicates whether the UE can be configured with enabledDefaultBeamForCCS for default QCL assumption for cross-carrier A-CSI-RS triggering for same/different numerologies | 6-5 | Yes | N/A |  | Per BC | N/A | N/A | N/A |  | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-7 | CA with non-aligned frame boundaries | CA with non-aligned frame boundaries for inter-band CA | 6-5 for DL CA with non-aligned frame boundaries for inter-band CA  6-6 for UL CA with non-aligned frame boundaries for inter-band CA | Yes | N/A |  | Per BC | N/A | N/A | N/A | Defines whether the UE supports carrier aggregation operation where the frame boundaries of the Pcell and the Scell are not aligned, while the slot boundaries are. | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-8 | HARQ-ACK codebook type and HARQ-ACK spatial bundling configuration per PUCCH group | HARQ-ACK codebook type and HARQ-ACK spatial bundling configuration per PUCCH group | 6-7 | Yes | N/A |  | Per UE | No | No | N/A | Support HARQ-ACK codebook type and HARQ-ACK spatial bundling configuration per PUCCH group.  Rel-15 had this per cell group | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-2 | Single UL TX operation for TDD PCell in EN-DC | TDM restriction to LTE TDD PCell in EN-DC for single UL-Transmission associated functionality when tdm-patternConfig-r16 is configured  1) TDD UL/DL configuration#2, #4, #5 configured as DL-reference UL/DL configuration  2) PRACH transmission in non- designated UL subframes given by the DL-reference configuration (only for type 1 UE)  3) LTE UL transmissions scheduled/triggered by a DCI in any UL subframe not limited to the reference TDM pattern (only for type 1 UE)  [4) dropping NR transmission when LTE and NR transmissions collide for Type 1 UE] | EN-DC | Yes | N/A |  | Per band combination | Applicable to TDD-TDD EN-DC only | Applicable to FR1 only |  | Extension of the R15 capability tdm-Pattern to TDD PCell  This FG is for synchronous EN-DC | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-2a | Enhanced single UL TX operation for FDD Pcell EN-DC | TDM restriction to LTE FDD Pcell in EN-DC for single UL-Transmission associated functionality when tdm-patternConfig-r16 is configured  1) DL-reference UL/DL configuration defined for LTE-FDD-SCell in LTE-TDD-FDD CA with LTE-TDD-PCell  2) PRACH transmission in non- designated UL subframes given by the DL-reference configuration (only for type 1 UE)  3) LTE UL transmissions scheduled/triggered by a DCI in any UL subframe not limited to the reference TDM pattern (only for type 1 UE)  [4) dropping NR transmission when LTE and NR transmissions collide for Type 1 UE] | 6-13 | Yes | N/A |  | Per band combination | Applicable to in FDD-LTE -NR EN-DC | Applicable to FR1 only |  | Enhancement to the R15 capability tdm-Pattern  [This FG is for synchronous EN-DC] | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-2b | Support of HARQ-offset for SUO case1 in EN-DC with LTE TDD PCell for type 1 UE | Support of HARQ-offset for SUO case1 in EN-DC with LTE TDD PCell for type 1 UE | 18-2 | Yes | N/A |  | Per band combination | N/A | N/A | N/A | [This FG is for synchronous EN-DC] | Optional with capability signaling |
| 18. MR-DC/CA enhancement | 18-3 | Dual Tx transmission for EN-DC with FDD PCell(TDM pattern for dual Tx UE) | TDM restriction to LTE FDD PCell in EN-DC for dual UL Tx operation when tdm-patternConfig-r16 is configured  1) DL-reference UL/DL configuration defined for LTE-FDD-SCell in LTE-TDD-FDD CA with LTE-TDD-PCell  2) PRACH transmission in non- designated UL subframes given by the DL-reference configuration (only for type 1 UE)  3) LTE UL transmissions scheduled/triggered by a DCI in any UL subframe not limited to the reference TDM pattern (only for type 1 UE) | 6-13, EN-DC | Yes | N/A |  | Per band combination | Applicable to EN-DC with LTE FDD PCell only | Applicable to FR1 only |  | Extension of the R15 capability tdm-Pattern to a dual Tx UE  [This FG is for synchronous EN-DC] | Optional with capability signalling |
| 18. MR-DC/CA enhancement | 18-3a | Semi-statically configured LTE UL transmissions in all UL subframes not limited to tdm-pattern in case of FDD PCell | UE configured with tdm-patternConfig-r16 can be semi-statically configured with LTE UL transmissions in all UL subframes not limited to the reference tdm-pattern (only for type 1 UE) in case of FDD PCell | 18-2a | Yes | N/A |  | Per UE | Applicable to EN-DC only | Applicable to FR1 only |  | [This FG is for synchronous EN-DC] | Optional with capability signaling |
| 18. MR-DC/CA enhancement | 18-3b | Semi-statically configured LTE UL transmissions in all UL subframes not limited to tdm-pattern in case of TDD PCell | UE configured with tdm-patternConfig-r16 can be semi-statically configured with LTE UL transmissions in all UL subframes not limited to the reference tdm-pattern (only for type 1 UE) in case of TDD PCell | One of {18-2, 18-3} | Yes | N/A |  | Per UE | Applicable to EN-DC only | Applicable to FR1 only |  | [This FG is for synchronous EN-DC] | Optional with capability signaling |

1. UE Power Saving

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | | Need for the gNB to know if the feature is supported | | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 19.UE Power Saving | 19-1 | DRX Adaptation | 1. Configured PS\_offset for the detection of  DCI format 2\_6  with CRC scrambling by PS-RNTI and reported minimum time gap before the start of drx\_onDurationTimer 2. Indication of UE whether  or not to start drx\_OnDuration timer for the next DRX cycle by detection of DCI format 2\_6 3. Configured UE wakeup or not when DCI format 2\_6 is not detected at all monitoring occasions outside Active time 4. Configured  periodic CSI report apart from L1-RSRP when  impacted by DCI format 2\_6 that drx\_OnDurationTimer does not start for the next DRX cycle 5. Configured periodic L1-RSRP report when  impacted by DCI format 2\_6 that drx\_OnDurationTimer does not start for the next DRX cycle | N/A | | Yes | | N/A |  | Per UE | No | Yes | N/A | The minimum time gap between the end of the slot of last DCI format 2\_6 monitoring occasion and the beginning of the slot where the UE would start the drx\_onDurationTimer is a UE capability based on subcarrier spacing.   * The reporting is per SCS in units of slots of the respective SCS * The candidate value set for 15kHz SCS: {1,3} slots * The candidate value set for 30kHz SCS: {1,6} slots * The candidate value set for 60kHz SCS: {1,12} slots * The candidate value set for 120kHz SCS: {2,24} slots   UE is not required to monitor PDCCH for detection of DCI format 2\_6 during the minimum time gap  Note: RAN1 agreed licensed/unlicensed differentiation is required for this FG. It is left to RAN2 how to implement this while leaving the type as “per UE” | Optional with capability signalling |
| 19-2 | Cross Slot Scheduling | (1)    Dynamic indication of applicable minimum scheduling restriction by  DCI format 0\_1 and 1\_1  minimumSchedulingOffset K0 configuration for PDSCH and aperiodic CSI-RS triggering offset  (2)    minimumSchedulingOffset K2 configuration for PUSCH | |  | | Yes | N/A | Dynamic adaptation of the minimum value of K0min/K2min for cross-slot scheduling is not supported | Per UE | No | No | N/A | Note: RAN1 agreed licensed/unlicensed differentiation is required for this FG. It is left to RAN2 how to implement this while leaving the type as “per UE” | Optional with capability signalling |
| 19-3 | Maximum MIMO Layer Adaptation | 1. 1.     Support of maximum number of MIMO layer configuration  per DL BWP | | See Note | | Yes | N/A |  | Per UE | No | Yes | N/A | This capability is indicated only if UE supports the network configuration of maxMIMO-Layers according to maxLayersMIMO-Indication | Optional with capability signalling |
| 19-4a | UE assistance information | Support of reporting preferred minimum K0/K2 via UE assistance information   * 15kHz/30kHz SCS: {1, 2, 4, 6} slots * 60kHz/120kHz SCS: {2, 4, 8, 12} slots | | 19-2 | | Yes | N/A |  | Per UE | No | No | N/A | The minimum applicable value of K0 (K2) for an active DL (UL) BWP for the carrier where PDSCH(PUSCH) is transmitted | Optional with capability signalling |
|  |  |  |  | |  | |  |  |  |  |  |  |  |  |  |

1. NR\_IAB

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | | Need for the gNB to know if the feature is supported | | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
|  | 20-2 | Inter-IAB-node discovery and measurements: SSB reception configuration | Support up to 4 SMTCs configured for an IAB node MT per frequency location, including IAB-specific SMTC window periodicities | |  | | Yes | N/A | Separate configuration of SMTC windows for Inter-IAB node discovery and measurement is not possible | per IAB node | No | No | support mixture of FDD/TDD and/or FR1/FR2 | IAB-MT impact | Optional with capability signalling. [Devices supporting IAB backhaul must report this FG as supported] |
| 20-3 | Extension of RACH occasions and periodicities for backhaul RACH resources | Support RACH configuration for IAB-MT separately from the RACH configuration for UE access, including new IAB-specific offset and scaling factors | |  | | Yes | N/A | Separate configuration of RACH transmissions for access UEs and IAB nodes is not possible | per IAB node | No | No | support mixture of FDD/TDD and/or FR1/FR2 | IAB-MT impact | Optional with capability signalling. [Devices supporting IAB backhaul must report this FG as supported] |
| 20-5a | UL-Flexible-DL slot formats | Support semi-static configuration/indication of UL-Flexible-DL slot formats for IAB-MT resources | | 5-1a | | Yes | N/A | Only Rel-15 slot formats can be configured for backhaul links | per IAB node | No | No | support mixture of FDD/TDD and/or FR1/FR2 | IAB-MT impact | Optional with capability signalling |
| 20-5b | UL-Flexible-DL slot formats | Support dynamic indication of UL-Flexible-DL slot formats for IAB-MT resources | | 3-6 | | Yes | N/A | Dynamic indication of UL-Flexible-DL slot formats for IAB-MT resources is not supported | per IAB node | No | No | support mixture of FDD/TDD and/or FR1/FR2 | IAB-MT impact | Optional with capability signalling |
| 20-6 | Dynamic indication of soft resource availability | Support monitoring DCI Format 2\_5 scrambled by AI-RNTI for indication of soft resource availability to an IAB node | |  | | Yes | N/A | Explicit indication of soft resource availability is not supported | per IAB node | No | No | support mixture of FDD/TDD and/or FR1/FR2 | IAB-MT impact | Optional with capability signalling. |
| 20-7 | Case 1 OTA timing alignment | Support T\_delta reception. | |  | | Yes | N/A | Case-1 OTA timing alignment is not supported | per IAB node | No | No | support mixture of FDD/TDD and/or FR1/FR2 | IAB-MT impact | Optional with capability signalling. |
|  | 20-8 | Guard symbols | 1)  Support DesiredGuardSymbols reporting  2) Support ProvidedGuardSymbols reception | |  | | Yes | N/A | Guard symbols reporting and reception is not supported | per IAB node | No | No | support mixture of FDD/TDD and/or FR1/FR2 | IAB-MT impact | Optional with capability signalling. |
|  |  |  |  | |  | |  |  |  |  |  |  |  |  |  |

1. Mobility Enhancement

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | | Need for the gNB to know if the feature is supported | | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 21. Mobility Enhancement | 21-1a | Intra-frequency DAPS HO | Support of  intra-frequency DAPS-HO     1. Support of simultaneous DL reception of PDCCH and PDSCH from source and target cell in DAPS-HO 2. Support of PDCCH blind decoding capability in the first MCG and second MCG. 3. Support of cancelling UL transmission to the source cell for intra-frequency DAPS-HO | | DAPS  (Note: RAN2 feature) | | Yes | N/A | The network cannot configure UE with DAPS HO | Per Band | No | N/A | N/A |  | Optional with capability signalling |
| 21-1b | Inter-frequency DAPS HO | Support of  inter-frequency DAPS-HO    1) Support of simultaneous DL reception of PDCCH and PDSCH from source and target cell in DAPS-HO    2) Support of PDCCH blind decoding capability in the first MCG and second MCG. | | DAPS  (Note: RAN2 feature) | | Yes | N/A | The network cannot configure UE with DAPS HO | Per BC | No | N/A | N/A |  | [Optional with capability signalling] |
| 21-2 | Semi-static UL power sharing mode 1 for DAPS HO | Support of semi-static power sharing mode1 between source and target cells of same FR | | DAPS  (Note: RAN2 feature) | | Yes | N/A | UE is not expected to simultaneously transmit PRACH/PUSCH/PUCCH/SRS to source and target cell that overlap in time domain | Per BC | No | N/A | N/A |  | Optional with capability signalling |
| 21-2a | Semi-static UL power sharing mode 2 for DAPS HO | Support of semi-static power sharing mode 2 between source and target cells of same FR | | 21-2 | | Yes | N/A |  | Per BC | No | N/A | N/A | only applicable to DAPS HO in synchronous scenarios | Optional with capability signalling |
| 21-2b | Dynamic UL power sharing for DAPS HO | Support of dynamic power sharing between source and target cells of same FR  1) T\_offset | | 21-2 | | Yes | N/A |  | Per BC | No | N/A | N/A | Candidate values for (1) are {short, long} | Optional with capability signalling |
| 21-2d | UL transmission cancellation | Indicates support of cancelling UL transmission to the source cell for inter-frequency DAPS-HO | | 21-1b | | Yes | N/A | UE does not support scheduling of overlapping PUSCH/PUCCH/SRS transmissions to source and target cells for inter-frequency DAPS-HO | per band combination | No | N/A | N/A |  | Optional with capability signalling |

1. Potential change/update on existing UE features for Rel-16 UE

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | | Need for the gNB to know if the feature is supported | | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 8. UL TPC | 8-1 | Dynamic power sharing for LTE-NR DC | When total transmission power exceeds Pcmax, UE scales NR transmission power. | | EN-DC | | No | N/A |  | Per UE | No | No |  |  | Mandatory with capability signalling set to 1 |

1. New FGs that are not dedicated to a specific Rel-16 work item/TEI

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 22. NR Others | 22-1 | Indicating supported option for UL Tx switching for inter-band UL CA | Indicating supported option for UL Tx switching for inter-band UL CA   * Candidate values set is {option1, option2, both option 1 and option 2} | 6-6 and RAN4 FG 7-1 (Tx switching period between two uplink carriers) | Yes | N/A |  | Per BC | N/A | N/A (FR1 only) | N/A | It has been agreed in RAN1 that UE can report support of one of the three candidates {option1, option2, both option1 and option2}. It is up to RAN2 to design the corresponding UE capability signalling. | Signaling of this FG is mandatory conditioned on the support of switching time capability for Tx switching between two uplink carriers in inter-band UL CA band combinations in RAN4 FG 7-1 (i.e. Tx switching period between two uplink carriers) |
| 22. NR Others | 22-2 | Indicating supported option for UL Tx switching for EN-DC | Indicating supported option for UL Tx switching for EN-DC   * Candidate values set is {option1, option2} | EN-DC and RAN4 FG 7-1 (Tx switching period between two uplink carriers) | Yes | N/A |  | Per BC | N/A | N/A (FR1 only) | N/A |  | Signaling of this FG is mandatory conditioned on the support of switching time capability for Tx switching between two uplink carriers in EN-DC in RAN4 FG 7-1 (i.e. Tx switching period between two uplink carriers) |
| 22. NR Others | 22-3a | CBG based transmission for UL with 1 unicast PUSCH per slot per CC with UE processing time Capability 2 | CBG based transmission for UL with 1 unicast PUSCH per slot per CC with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-3b | CBG based transmission for UL with up to 2 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 2 | CBG based transmission for UL with up to 2 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-3c | CBG based transmission for UL with up to 7 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 2 | CBG based transmission for UL with up to 7 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-3d | CBG based transmission for UL with up to 4 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 2 | CBG based transmission for UL with up to 4 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-3e | CBG based transmission for DL with 1 unicast PDSCH per slot per CC with UE processing time Capability 2 | CBG based transmission for DL with 1 unicast PDSCH per slot per CC with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-3f | CBG based transmission for DL with up to 2 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 2 | CBG based transmission for DL with up to 2 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-3g | CBG based transmission for DL with up to 7 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 2 | CBG based transmission for DL with up to 7 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-3h | CBG based transmission for DL with up to 4 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 2 | CBG based transmission for DL with up to 4 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 2 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4a | CBG based transmission for UL with 1 unicast PUSCH per slot per CC with UE processing time Capability 1 | CBG based transmission for UL with 1 unicast PUSCH per slot per CC with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4b | CBG based transmission for UL with up to 2 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 1 | CBG based transmission for UL with up to 2 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4c | CBG based transmission for UL with up to 7 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 1 | CBG based transmission for UL with up to 7 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4d | CBG based transmission for UL with up to 4 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 1 | CBG based transmission for UL with up to 4 unicast PUSCHs per slot per CC for different TBs with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4e | CBG based transmission for DL with 1 unicast PDSCH per slot per CC with UE processing time Capability 1 | CBG based transmission for DL with 1 unicast PDSCH per slot per CC with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4f | CBG based transmission for DL with up to 2 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 1 | CBG based transmission for DL with up to 2 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4g | CBG based transmission for DL with up to 7 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 1 | CBG based transmission for DL with up to 7 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |
| 22. NR Others | 22-4h | CBG based transmission for DL with up to 4 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 1 | CBG based transmission for DL with up to 4 unicast PDSCHs per slot per CC for different TBs with UE processing time Capability 1 |  | Yes | N/A |  | Per FS | N/A | N/A |  | This capability is necessary for each SCS | Optional with capability signalling |