**3GPP TSG-RAN WG2 Meeting #117-e *R2-220xxxx***

**Electronic meeting, February 21 – March 3, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.822** | **CR** | **0009** | **rev** | **1** | **Current version:** | **16.2.0** |  |
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| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Miscellaneous updates on TR38.822 | | | | | | | | | |
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| ***Source to WG:*** | Intel Corporation | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos-Core, NR\_RF\_TxD-Core, NR\_unlic-Core, NR\_IAB-Core | | | | |  | ***Date:*** | | | 2022-02-14 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)*  *Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | Updates the feature list tables based on the following:   * R2-2109178 Miscellaneous corrections to 38.306 * R4-2118537 R4 feature list – The corresponding 38.306/331 CRs are already agreed in R2-2111502 and R2-2111503 on TX diversity * R1-2112777 R1 feature list * Further updates as follow after offline discussion:   + Remove grey background from the capabilities in 2-20, 2-21, 2-21 (RAN2).   + Renumber “2-21 (RAN2)”, “2-22 (RAN2)” to “2-22 (RAN2)”, “2-23 (RAN2)”. | | | | | | | | |
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| ***Summary of change:*** | | Updates the feature list tables as follows:   * Update table 5.1.2 on NR-u to update according to the name change in R2-2109178 * Update table 5.1.5 on NR positioning to update according to R1 feature list R1-2112777. * Update table 5.3.12 to include Transparent Tx Diversity (from latest R4 feature list R4-2118537) * Other miscellaneous corrections in 5.1.12.   Interoperability impact: None | | | | | | | | |
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| ***Consequences if not approved:*** | | 38.822 will not be aligned with R1 and R4 feature list and TS38.306 spec. | | | | | | | | |
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| ***Clauses affected:*** | | 5.1.2, 5.1.5, 5.1.12, 5.3.12 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
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| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

START OF 1st CHANGE

### 5.1.2 NR-unlicensed

Table 5.1.2-1: Layer-1 feature list for NR-unlicensed

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Field name in TS 38.331 [2] | **Parent IE in TS 38.331 [2]** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Note | Mandatory/Optional |
| 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 |  | *ul-DynamicChAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A2, B, C, D and E with dynamic channel access mode |
| 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 |  | *ul-Semi-StaticChAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A2, B, C, D and E with semi-static channel access mode |
| 10-2 | SSB-based RRM for dynamic channel access mode | 1. SSB-based RRM with Q for dynamic channel access mode |  | *ssb-RRM-DynamicChAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Q indicates the value of RAN1 parameter  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A1, A2, B, C, D and E with dynamic channel access mode |
| 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 |  | *ssb-RRM-Semi-StaticChAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Q indicates the value of RAN1 parameter  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A1, A2, B, C, D and E with semi-static channel access mode |
| 10-2b | MIB reading on unlicensed cell | 1. MIB reading on unlicensed cell for PCell and PSCell |  | *mib-Acquisition-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario B, C, D and E |
|  | 10-2c | SSB-based RLM for dynamic channel access mode | 1. SSB-based RLM with Q for dynamic channel access mode |  | *ssb-RLM-DynamicChAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Q indicates the value of RAN1 parameter  the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-3 applies to licensed band operation only, and functionalities of FG1-3 is covered by FG10-2c/2d in unlicensed band operation. | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario B, C, D and E with dynamic channel access mode |
|  | 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 |  | *ssb-RLM-Semi-StaticChAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Q indicates the value of RAN1 parameter  the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-3 applies to licensed band operation only, and functionalities of FG1-3 is covered by FG10-2c/2d in unlicensed band operation. | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario B, C, D and E with semi-static channel access mode |
|  | 10-2e | SIB1 reception on unlicensed cell | 1. SIB1 reception on unlicensed cell for PCell |  | *sib1-Acquisition-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario C and D |
|  | 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 |  | *extRA-ResponseWindow-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-2g | SSB-based BFD/CBD for dynamic channel access mode | SSB-based BFD/CBD with Q for dynamic channel access mode |  | *ssb-BFD-CBD-dynamicChannelAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Q indicates the value of RAN1 parameter  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling |
|  | 10-2h | SSB-based BFD/CBD for semi-static channel access mode | SSB-based BFD/CBD with Q for semi-static channel access mode |  | *ssb-BFD-CBD-semi-staticChannelAccess-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Q indicates the value of RAN1 parameter  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling |
|  | 10-2i | CSI-RS-based BFD/CBD for operation with shared spectrum channel access | CSI-RS-based BFD/CBD for operation with shared spectrum channel access |  | *csi-RS-BFD-CBD-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-7 | UL channel access for 10 MHz SCell | 10 MHz LBT bandwidth | one of {10-1, 10-1a} | *ul-ChannelBW-SCell-10mhz-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-10 | RSSI and channel occupancy measurement and reporting | 1. RSSI measurement  Channel occupancy reporting |  | *rssi-ChannelOccupancyReporting-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-11 | SRS starting position at any OFDM symbol in a slot | 2. Support transmitting SRS starting in all symbols (0,…,13) of a slot |  | *srs-StartAnyOFDM-Symbol-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a |  | Optional with capability signaling |
|  | 10-20 | Support search space set configuration with freqMonitorLocation-r16 | 3. Maximum number of frequency domain locations for a search space set configuration with freqMonitorLocations-r16 |  | *searchSpaceFreqMonitorLocation-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-20a | Support coreset configuration with rb-Offset | 4. Support coreset configuration with rb-Offset |  | *coreset-RB-Offset-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a |  | Optional with capability signaling |
|  | 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 |  | *cgi-Acquisition-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Support reading RMSI from an unlicensed cell for ANR  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling |
|  | 10-25 | 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 |  | *configuredUL-Tx-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-27 | Wideband PRACH | Enhanced PRACH design for operation with shared spectrum channel access by adopting a single long ZC sequence, with ZC sequence = 1151 for 15kHz and ZC sequence = 571 for 30kHz |  | *prach-Wideband-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-29 | Support available RB set indicator field in DCI 2\_0 | Support monitoring DCI 2\_0 to read availableRB-Sets-r16 |  | *dci-AvailableRB-Set-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-30 | Support channel occupancy duration indicator field in DCI 2\_0 | Support monitoring DCI 2\_0 to read COT duration |  | *dci-ChOccupancyDuration-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-8 | Type B PDSCH length {3, 5, 6, 8, 9, 10, 11, 12, 13} without DMRS shift due to CRS collision | Type B PDSCH length {3, 5, 6, 8, 9, 10, 11, 12, 13} without DMRS shift due to CRS collision | 5-6a | *typeB-PDSCH-length-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-9 | 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 |  | *searchSpaceSwitchWithDCI-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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.  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-9b | 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 |  | *searchSpaceSwitchWithoutDCI-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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.  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-9c | Joint search space group switching across multiple cells | Configured with a group of cells and switch search space set group jointly over these cells | one of {10-9, 10-9b} | *jointSearchSpaceGroupSwitchingAcrossCells-r16* | *CA-ParametersNR-v1610* | n/a | n/a | Without this capability, the UE will switch search space set groups for different cells independently  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-9d | Support Search space set group switching capability 2 | Search space set group switching Capability-2: P=10/12/22 symbols for µ = 0/1/2 SCS | one of {10-9, 10-9b} | *searchSpaceSetGroupSwitchingcapability2-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-14 | Non-numerical PDSCH to HARQ-ACK timing | Support configuration of a value for dl-DataToUL-ACK indicating an inapplicable time to report HARQ ACK |  | *non-numericalPDSCH-HARQ-timing-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-15 | 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) |  | *enhancedDynamicHARQ-codebook-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Enhanced dynamic HARQ codebook supporting grouping of HARQ ACK and triggering the retransmission of HARQ ACK in each group | Optional with capability signalling |
|  | 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 |  | *oneShotHARQ-feedback-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-17 | Multi-PUSCH UL grant | 1. Support of scheduling up to 8 PUSCH with a single DCI 0\_1 |  | *multiPUSCH-UL-grant-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a |  | Optional with capability signalling |
|  | 10-26 | CSI-RS based RLM for operation with shared spectrum channel access | CSI-RS based RLM for operation with shared spectrum channel access |  | *csi-RS-RLM-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-7 applies to licensed band operation only, and functionalities of FG1-7 is covered by FG10-26 in unlicensed band operation. | Optional with capability signalling |
|  | 10-26a |  |  |  |  |  |  |  | RAN1 respectfully ask RAN2 to make the capability bit for this FG as dummy. |  |
|  | 10-26b | CSI-RS based RRM measurement with associated SS-block for operation with shared spectrum channel access | 1) CSI-RSRP measurement for operation with shared spectrum channel access  2) CSI-RSRQ measurement for operation with shared spectrum channel access |  | *csi-RSRP-AndRSRQ-MeasWithSSB-r16* | *SharedSpectrumChAccessParamsPerBand-v1640* | n/a | n/a | the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-4 applies to licensed band operation only, and functionalities of FG1-4 is covered by FG10-26b in unlicensed band operation. | Optional with capability signalling |
|  | 10-26c | CSI-RS based RRM measurement without associated SS-block for operation with shared spectrum channel access | 1) CSI-RSRP measurement for operation with shared spectrum channel access  2) CSI-RSRQ measurement for operation with shared spectrum channel access  3) There is SS-block in the target frequency on which the RRM measurement is performed for operation with shared spectrum channel access |  | *csi-RSRP-AndRSRQ-MeasWithoutSSB-r16* | *SharedSpectrumChAccessParamsPerBand-v1640* | n/a | n/a | the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-5 applies to licensed band operation only, and functionalities of FG1-5 is covered by FG10-26c in unlicensed band operation. | Optional with capability signalling |
|  | 10-26d | CSI-RS based RS-SINR measurement for operation with shared spectrum channel access | CSI-SINR measurements for operation with shared spectrum channel access | 10-26b | *csi-SINR-Meas-r16* | *SharedSpectrumChAccessParamsPerBand-v1640* | n/a | n/a | the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-6 applies to licensed band operation only, and functionalities of FG1-6 is covered by FG10-26d in unlicensed band operation. | Optional with capability signalling |
|  | 10-26e | RLM based on a mix of SS block and CSI-RS signals within active BWP for operation with shared spectrum channel access | RLM based on a mix of SS block and CSI-RS signals within active BWP for operation with shared spectrum channel access | 10-26, one of {10-2c, 10-2d} | *ssb-AndCSI-RS-RLM-r16* | *SharedSpectrumChAccessParamsPerBand-v1640* | n/a | n/a | the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-8 applies to licensed band operation only, and functionalities of FG1-8 is covered by FG10-26e in unlicensed band operation. | Optional with capability signalling |
|  | 10-26f | CSI-RS based contention free RA for HO for operation with shared spectrum channel access | CSI-RS based contention free RA for HO for operation with shared spectrum channel access | One of {10-26b, 10-26c} | *csi-RS-CFRA-ForHO-r16* | *SharedSpectrumChAccessParamsPerBand-v1640* | n/a | n/a | the signaling is per band but is only expected for a band where shared spectrum channel access must be used  Note: Rel-15 FG1-9 applies to licensed band operation only, and functionalities of FG1-9 is covered by FG10-26f in unlicensed band operation. | Optional with capability signalling |
|  | 10-31 | Support of P/SP-CSI-RS reception with CSI-RS-ValidationWith-DCI-r16 configured | 1. Validate P/SP-CSI-RS reception when receiving a DCI granting a PDSCH over the same set of symbols  2. Validate P/SP-CSI-RS reception when receiving a DCI triggering a A-CSI-RS over the same set of symbols |  | *periodicAndSemi-PersistentCSI-RS-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | If UE does not signal capability for FG 10-31, the UE cannot be configured with CSI-RS-ValidationWith-DCI-r16.  If none of the RRC parameters CO-DurationPerCell-r16, SlotFormatIndicator, and CSI-RS-ValidationWith-DCI-r16 is configured on a cell with shared spectrum access, and P/SP CSI-RS is configured, for reception/cancellation of SP/P CSI-RS the behavior in 11.1 of TS38.213 applies as per agreement.  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signaling |
|  | 10-3 | PRB interlace mapping for PUSCH | 1. PRB interlace frequency domain resource allocation for PUSCH |  | *pusch-PRB-interlace-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Support of PRB interlace PUSCH  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-3a | 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 |  | *pucch-F0-F1-PRB-Interlace-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Support of PRB interlace PUCCH format 0/1  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-12 | OCC for PRB interlace mapping for PF2 and PF3 | 1. OCC2  2. OCC4 | 10-3a | *occ-PRB-PF2-PF3-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | UE OCC capability for EPF2/EFP3  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-13a | Extended CP range of more than one symbol for CG-PUSCH | 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} | *extCP-rangeCG-PUSCH-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | How long a UE can generate the CP extension beyond 1 symbol for CG-PUSCH  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-18 | 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} | *configuredGrantWithReTx-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | n/a | n/a | Support configured grant with retransmission in configured grant resource  the signaling is per band but is only expected for a band where shared spectrum channel access must be used | Optional with capability signalling |
|  | 10-21a | 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 | *ed-Threshold-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 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 | *ul-DL-COT-Sharing-r16* | *SharedSpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-24 | CG-UCI multiplexing with HARQ ACK | 1. Support multiplexing CG-UCI with HARQ ACK | 10-18 | *mux-CG-UCI-HARQ-ACK-r16* | *SpectrumChAccessParamsPerBand-r16* | 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 |
|  | 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} | *cg-resourceConfig-r16* | *SpectrumChAccessParamsPerBand-r16* | 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 |
|  | 10-32 | SS block based SINR measurement (SS-SINR) for unlicensed spectrum | SS-SINR measurement for unlicensed spectrum |  | *ss-SINR-Meas-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG1-2 applies to licensed band operation only, and functionalities of FG1-2 is covered by FG10-32 in unlicensed band operation. | Optional with capability signaling |
|  | 10-33 | Semi-persistent CSI report on PUCCH for unlicensed spectrum | 1) Support report on PUCCH formats over 1 – 2 OFDM symbols once per slot (or piggybacked on a PUSCH) for unlicensed spectrum  2) Support report on PUCCH formats over 4 – 14 OFDM symbols once per slot (or piggybacked on a PUSCH) for unlicensed spectrum |  | *sp-CSI-ReportPUCCH-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG2-32a applies to licensed band operation only, and functionalities of FG2-32a is covered by FG10-33 in unlicensed band operation. | Optional with capability signaling |
|  | 10-33a | Semi-persistent CSI report on PUSCH for unlicensed spectrum | Support semi-persistent CSI report on PUSCH for unlicensed spectrum |  | *sp-CSI-ReportPUSCH-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG2-32b applies to licensed band operation only, and functionalities of FG2-32b is covered by FG10-33a in unlicensed band operation. | Optional with capability signaling |
|  | 10-34 | Dynamic SFI monitoring for unlicensed spectrum | Adjust periodic and semi-persistent signal reception and transmission in response to detected dynamic UL/DL configuration for unlicensed spectrum |  | *dynamicSFI-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG3-6 applies to licensed band operation only, and functionalities of FG3-6 is covered by FG10-34 in unlicensed band operation.  Regarding the interpretation of UE capabilities in case of cross-carrier operation, support of the FG10-34 is based on both the support of this capability for the band of the scheduled/triggered/indicated cell and the support of this capability for the band of the scheduling/triggering/indicating cell. | Optional with capability signaling |
|  | 10-35 | SR/HARQ-ACK/CSI multiplexing once per slot using a PUCCH (or HARQ-ACK/CSI piggybacked on a PUSCH) when SR/HARQ-ACK/CSI are supposed to be sent with the same starting symbol on the PUCCH resources in a slot for unlicensed spectrum | SR/HARQ-ACK/CSI multiplexing once per slot, where overlapping PUCCH resources have the same starting symbols on the PUCCH resources in a slot while precluding the case of SR/HARQ-ACK by overlapping PUCCH resources with the same starting symbols on the PUCCH resources in a slot for unlicensed spectrum |  | *mux-SR-HARQ-ACK-CSI-PUCCH-OncePerSlot-r16*  *{*  *sameSymbol-r16,*  *diffSymbol-r16*  *}* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG4-19 applies to licensed band operation only, and functionalities of FG4-19 is covered by FG10-35 in unlicensed band operation. | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A2, B, C, D and E |
|  | 10-35a | SR/HARQ-ACK multiplexing once per slot 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 slot for unlicensed spectrum | Overlapping PUCCH resources have different starting symbols in a slot for unlicensed spectrum | 10-35 | *mux-SR-HARQ-ACK-PUCCH-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG4-19a applies to licensed band operation only, and functionalities of FG4-19a is covered by FG10-35a in unlicensed band operation. | Optional with capability signaling |
|  | 10-35b | SR/HARQ-ACK/CSI multiplexing more than once per slot using a PUCCH (or HARQ-ACK/CSI piggybacked on a PUSCH) when SR/HARQ-ACK/CSI are supposed to be sent with the same or different starting symbol in a slot for unlicensed spectrum | Overlapping PUCCH resources have same or different starting symbols in a slot for unlicensed spectrum | 10-35c | *mux-SR-HARQ-ACK-CSI-PUCCH-MultiPerSlot-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG4-19b applies to licensed band operation only, and functionalities of FG4-19b is covered by FG10-35b in unlicensed band operation. | Optional with capability signaling |
|  | 10-35c | SR/HARQ-ACK/CSI multiplexing once per slot using a PUCCH (or HARQ-ACK/CSI piggybacked on a PUSCH) when SR/HARQ-ACK/CSI are supposed to be sent with different starting symbols in a slot for unlicensed spectrum | Overlapping PUCCH resources have different starting symbols in a slot for unlicensed spectrum | 10-35a | *mux-SR-HARQ-ACK-CSI-PUCCH-OncePerSlot-r16*  *{*  *sameSymbol-r16,*  *diffSymbol-r16*  *}* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG4-19c applies to licensed band operation only, and functionalities of FG4-19c is covered by FG10-35c in unlicensed band operation. | Optional with capability signaling |
|  | 10-36 | HARQ-ACK multiplexing on PUSCH with different PUCCH/PUSCH starting OFDM symbols for unlicensed spectrum | HARQ-ACK piggyback on a PUSCH with/without aperiodic CSI once per slot when the starting OFDM symbol of the PUSCH is different from the starting OFDM symbols of the PUCCH resource that HARQ-ACK would have been transmitted on for unlicensed spectrum |  | *mux-HARQ-ACK-PUSCH-DiffSymbol-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG4-28 applies to licensed band operation only, and functionalities of FG4-28 is covered by FG10-36 in unlicensed band operation. | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A2, B, C, D and E |
|  | 10-37 | Repetitions for PUCCH format 1, 3, and 4 over multiple slots with K = 2, 4, 8 for unlicensed spectrum | Repetitions for PUCCH format 1, 3, and 4 over multiple slots with K = 2, 4, 8 for unlicensed spectrum |  | *pucch-Repetition-F1-3-4-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG4-23 applies to licensed band operation only, and functionalities of FG4-23 is covered by FG10-37 in unlicensed band operation. | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A2 (whenever PUCCH is supported on NR-U cell), B, C, D and E |
|  | 10-38 | Type 1 configured PUSCH repetitions over multiple slots for unlicensed spectrum | K = 2, 4, 8 times repetitions with RV sequences for unlicensed spectrum |  | *type1-PUSCH-RepetitionMultiSlots-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-14 applies to licensed band operation only, and functionalities of FG5-14 is covered by FG10-38 in unlicensed band operation. | Optional with capability signaling |
|  | 10-39 | Type 2 configured PUSCH repetitions over multiple slots for unlicensed spectrum | K = 2, 4, 8 times repetitions with RV sequences for unlicensed spectrum |  | *type2-PUSCH-RepetitionMultiSlots-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-16 applies to licensed band operation only, and functionalities of FG5-16 is covered by FG10-39 in unlicensed band operation. | Optional with capability signaling |
|  | 10-40 | PUSCH repetitions over multiple slots for unlicensed spectrum | K = 2, 4, 8 times repetitions for unlicensed spectrum |  | *pusch-RepetitionMultiSlots-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-17 applies to licensed band operation only, and functionalities of FG5-17 is covered by FG10-40 in unlicensed band operation. | Optional with capability signaling  This FG is a part of basic operation for following scenarios defined in TS38.300  Scenario A2, B, C, D and E |
|  | 10-40a | PDSCH repetitions over multiple slots for unlicensed spectrum | K = 2, 4, 8 times repetitions for unlicensed spectrum |  | *pdsch-RepetitionMultiSlots-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-17a applies to licensed band operation only, and functionalities of FG5-17a is covered by FG10-40a in unlicensed band operation. | Optional with capability signaling |
|  | 10-41 | DL SPS for unlicensed spectrum | DL SPS for unlicensed spectrum |  | *downlinkSPS-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-18 applies to licensed band operation only, and functionalities of FG5-18 is covered by FG10-41 in unlicensed band operation. | Optional with capability signaling |
|  | 10-42 | Type 1 Configured UL grant for unlicensed spectrum | K = 1 for unlicensed spectrum |  | *configuredUL-GrantType1-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-19 applies to licensed band operation only, and functionalities of FG5-19 is covered by FG10-42 in unlicensed band operation. | Optional with capability signaling |
|  | 10-43 | Type 2 Configured UL grant for unlicensed spectrum | K = 1 for unlicensed spectrum |  | *configuredUL-GrantType2-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-20 applies to licensed band operation only, and functionalities of FG5-20 is covered by FG10-43 in unlicensed band operation. | Optional with capability signaling |
|  | 10-44 | Pre-emption indication for DL for unlicensed spectrum | Pre-emption indication for DL for unlicensed spectrum |  | *pre-EmptIndication-DL-r16* | *Phy-ParametersSharedChAccess-r16* | No | No | Note: Rel-15 FG5-21 applies to licensed band operation only, and functionalities of FG5-21 is covered by FG10-44 in unlicensed band operation. | Optional with capability signaling |

END OF 1st CHANGE

START OF 2nd CHANGE

### 5.1.5 NR positioning

Table 5.1.5-1: Layer-1 feature list for NR positioning

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Field name in TS 38.331 | Parent IE in TS 38.331 | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | 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}  2. DL PRS buffering capability: Type 1 or Type 2  a) Type 1 – sub-slot/symbol level buffering  b) Type 2 – slot level buffering  3. 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.  a) T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms  b) N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms  4. Max number of DL PRS resources that UE can process in a slot under it  a) FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  b) 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%. |  | *1 supportedBandwidthPRS-r16*  *2 dl-PRS-BufferType-r16*  *3 durationOfPRS-Processing-r16*  *4 maxNumOfDL-PRS-ResProcessedPerSlot-r16* | *PRS-ProcessingCapabilityPerBand-r16*  *LPP* | 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  Note: if the UE does not indicate this capability for a band or band combination, the UE does not support PRS processing in this band or band combination. | Optional with capability signaling |
|  | 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} |  | *maxSupportedFreqLayers-r16* | *NR-DL-PRS-ProcessingCapability-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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}  2. Max number of TRPs across all positioning frequency layers per UE.  Values = {4, 6, 12, 16, 24, 32, 64, 128, 256}  3. Max number of positioning frequency layers UE supports  Values = {1, 2, 3, 4} | 13-1 | *1 maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer-r16*  *2 maxNrOfTRP-AcrossFreqs-r16*  *3 maxNrOfPosLayer-r16* | *NR-DL-PRS-ResourcesCapability-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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  2. 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 | *1 maxNrOfDL-PRS-ResourcesPerResourceSet-r16*  *2 maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16* | *DL-PRS-ResourcesCapabilityPerBand-r16*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported.  Note: if the UE does not indicate this capability for a band or band combination, the UE does not support this positioning method in this band or band combination. | Optional with capability signaling |
|  | 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.  2. 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  3. 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, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands  4. 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 | *1 fr1-Only-r16*  *2 fr2-Only-r16*  *3 fr1-r16/ fr1-FR2Mix-r16*  *4 fr2-r16/ fr1-FR2Mix-r16* | *maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16/*  *DL-PRS-ResourcesBandCombination-r16*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported.  the reported value is the total number across all bands in the corresponding BC  Note: if the UE does not indicate this capability for a band or band combination, the UE does not support this positioning method in this band or band combination. | Optional with capability signaling |
|  | 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}  2. Max number of TRPs across all positioning frequency layers per UE.  Values = {4, 6, 12, 16, 24, 32, 64, 128, 256}  3. Max number of positioning frequency layers UE supports  Values = {1, 2, 3, 4} | 13-1 | *1 maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer-r16*  *2 maxNrOfTRP-AcrossFreqs-r16*  *3 maxNrOfPosLayer-r16* | *NR-DL-PRS-ResourcesCapability-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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  2. 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 | *1 maxNrOfDL-PRS-ResourcesPerResourceSet-r16*  *2 maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16* | *DL-PRS-ResourcesCapabilityPerBand-r16*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported.  Note: if the UE does not indicate this capability for a band or band combination, the UE does not support this positioning method in this band or band combination. | Optional with capability signaling |
|  | 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.  2. 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  3. 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, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands  4. 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 | *1 fr1-Only-r16*  *2 fr2-Only-r16*  *3 fr1-r16/ fr1-FR2Mix-r16*  *4 fr2-r16/ fr1-FR2Mix-r16* | *maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16/*  *DL-PRS-ResourcesBandCombination-r16*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported.  the reported value is the total number across all bands in the corresponding BC  Note: if the UE does not indicate this capability for a band or band combination, the UE does not support this positioning method in this band or band combination. | Optional with capability signaling |
|  | 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}  2. Max number of TRPs across all positioning frequency layers per UE.  Values = {4, 6, 12, 16, 24, 32, 64, 128, 256}  3. Max number of positioning frequency layers UE supports  Values = {1, 2, 3, 4} | 13-1 | *1 maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer-r16*  *2 maxNrOfTRP-AcrossFreqs-r16*  *3 maxNrOfPosLayer-r16* | *NR-DL-PRS-ResourcesCapability-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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  2. 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 | *1 maxNrOfDL-PRS-ResourcesPerResourceSet-r16*  *2 maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16* | *DL-PRS-ResourcesCapabilityPerBand-r16*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported.  Note: if the UE does not indicate this capability for a band or band combination, the UE does not support this positioning method in this band or band combination. | Optional with capability signaling |
|  | 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.  2. 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  3. 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, 96, 128, 192, 256, 512, 1024, 2048}  Note this is reported for BC containing FR1 and FR2 bands  4. 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 | *1 fr1-Only-r16*  *2 fr2-Only-r16*  *3 fr1-r16/ fr1-FR2Mix-r16*  *4 fr2-r16/ fr1-FR2Mix-r16* | *maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16/*  *DL-PRS-ResourcesBandCombination-r16*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported.  the reported value is the total number across all bands in the corresponding BC  Note: if the UE does not indicate this capability for a band or band combination, the UE does not support this positioning method in this band or band combination. | Optional with capability signaling |
|  | 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, | *maxDL-PRS-RSRP-MeasurementFR1-r16*  *maxDL-PRS-RSRP-MeasurementFR2-r16* | *NR-DL-AoD-MeasurementCapability*  *LPP* | No | Yes | 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 |
|  | 13-6 | DL PRS Measurement Report for DL-TDOA | 1. DL RSTD measurements per pair of TRPs. Values = {1, 2, 3, 4}  2. Support DL PRS-RSRP measurements. Values = {0, 1} | 13-3 | *dl-RSTD-MeasurementPerPairOfTRP-FR1-r16*  *dl-RSTD-MeasurementPerPairOfTRP-FR2-r16* | *NR-DL-TDOA-MeasurementCapability-r16*  *LPP* | No | Yes | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 13-7 | Support of SSB from neighbour cell as QCL source of a DL PRS | 1. Support of SSB from neighbour cell as QCL source of a DL PRS  2. 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 | *ssb-FromNeighCellAsQCL-r16* | *DL-PRS-QCL-ProcessingCapabilityPerBand-r16*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 13-7a | Support of DL PRS from serving/neighbour cell as QCL source of a DL PRS | 1. Support of DL PRS from serving/neighbour cell as QCL source of a DL PRS  Note 1: Refers to Type-D support for FR2  Note 2: A PRS from a PRS-only TP is treated as PRS from a non-serving cell | 13-1 | *prs-FromServNeighCellAsQCL-r16* | *DL-PRS-QCL-ProcessingCapabilityPerBand-r16*  *LPP* | 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 |
|  | 13-8 | 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}.  2. Max number of P/SP/AP SRS Resources for positioning per BWP.  Values = {1,2,4,8,16,32,64}  3. 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}  Note: Max number of P/SP/AP SRS Resources in Component 3 include both SRS resources configured by SRS-Resource and SRS resources configured by SRS-PosResource-r16 supported by UE  4. Max number of periodic SRS Resources for positioning per BWP.  Values = {1,2,4,8,16,32,64}  5. Max number of periodic SRS Resources for positioning per BWP per slot.  Values = {1,2,3,4,5,6,8,10,12,14}  OLPC for SRS for positioning based on SSB from serving cell is part of FG13-8  Note: no dedicated capability signaling is intended for this component |  | *RRC*  *1 maxNumberSRS-PosResourceSetPerBWP-r16*  *2 maxNumberSRS-PosResourcesPerBWP-r16*  *3 maxNumberSRS-ResourcesPerBWP-PerSlot-r16*  *4 maxNumberPeriodicSRS-PosResourcesPerBWP-r16*  *5 maxNumberPeriodicSRS-PosResourcesPerBWP-PerSlot-r16* | *RRC*  *SRS-AllPosResources-r16 /SRS-AllPosResources-r16* | n/a | n/a | Note: if the UE does not indicate this capability for a band in a band combination, the UE does not support SRS for Positioning in this band in the band combination.  - UE not supporting FG13-8 does not support FG13-8a or FG13-8b in the band in the band combination.  - The same approach is applicable to FG13-8c, FG13-8d, and FG13-8e. | Optional with capability signaling |
|  | 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}  2. 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 | *RRC*  *1 maxNumberAP-SRS-PosResourcesPerBWP-r16*  *2 maxNumberAP-SRS-PosResourcesPerBWP-PerSlot-r16* | *RRC*  *SRS-PosResourceAP-r16 /SRS-AllPosResources-r16* | n/a | n/a |  | Optional with capability signaling |
|  | 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}  2. 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 | *RRC*  *1 maxNumberSP-SRS-PosResourcesPerBWP-r16*  *2 maxNumberSP-SRS-PosResourcesPerBWP-PerSlot-r16* | *RRC*  *SRS-PosResourceSP-r16 /SRS-AllPosResources-r16* | n/a | n/a |  | Optional with capability signaling |
|  | 13-8c | 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}.  2. Max number of P/SP/AP SRS Resources for positioning per BWP.  Values = {1,2,4,8,16,32,64}  3. Max number of periodic SRS Resources for positioning per BWP.  Values = {1,2,4,8,16,32,64} | 13-8 | *LPP*  *1 maxNumberSRS-PosResourceSetsPerBWP-r16*  *2 maxNumberSRS-PosResourcesPerBWP-r16*  *3maxNumberPeriodicSRS-PosResourcesPerBWP-r16* | *LPP*  *SRS-PosResourcesPerBand-r16* | n/a | n/a | Need for location server to know if the feature is supported  UE only reports the number on bands for the current configured CA band combination. | Optional with capability signaling |
|  | 13-8d | 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} | 13-8a, 13-8c | *LPP*  *1 maxNumberAP-SRS-PosResourcesPerBWP-r16* | *LPP*  *SRS-PosResourcesPerBand-r16* | n/a | n/a | Need for location server to know if the feature is supported.  UE only reports the number on bands for the current configured CA band combination. | Optional with capability signaling |
|  | 13-8e | 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} | 13-8b,13-8c | *LPP*  *1 maxNumberSP-SRS-PosResourcesPerBWP-r16* | *LPP*  *SRS-PosResourcesPerBand-r16* | n/a | n/a | Need for location server to know if the feature is supported.  UE only reports the number on bands for the current configured CA band combination. | Optional with capability signaling |
|  | 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 | *LPP*  *olpc-SRS-PosBasedOnPRS-Serving-r16*  *RRC*  *olpc-SRS-PosBasedOnPRS-Serving-r16* | *LPP*  *OLPC-SRS-Pos-r16*  *RRC*  *OLPC-SRS-Pos-r16* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported | Optional with capability signaling |
|  | 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 | *LPP*  *olpc-SRS-PosBasedOnSSB-Neigh-r16*  *RRC*  *olpc-SRS-PosBasedOnSSB-Neigh-r16* | *LPP*  *OLPC-SRS-Pos-r16*  *RRC*  *OLPC-SRS-Pos-r16* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported | Optional with capability signaling |
|  | 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  Note: A PRS from a PRS-only TP is treated as PRS from a non-serving cell | 13-9 | *LPP*  *olpc-SRS-PosBasedOnPRS-Neigh-r16*  *RRC*  *olpc-SRS-PosBasedOnPRS-Neigh-r16* | *LPP*  *OLPC-SRS-Pos-r16*  *RRC*  *OLPC-SRS-Pos-r16* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported | Optional with capability signaling |
|  | 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} | *LPP*  *maxNumberPathLossEstimatePerServing-r16*  *RRC*  *maxNumberPathLossEstimatePerServing-r16* | *LPP*  *OLPC-SRS-Pos-r16*  *RRC*  *OLPC-SRS-Pos-r16* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported  SRS and SSB and/or PRS are in the same band  Note: if the UE does not indicate this capability for a band, the UE does not support any pathloss estimates in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions in that band. | Optional with capability signaling |
|  | 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} | *LPP*  *maxNumberSRS-PosPathLossEstimateAllServingCells-r16*  *RRC*  *maxNumberSRS-PosPathLossEstimateAllServingCells-r16* | *LPP*  *NR-UL-SRS-Capability-r16*  *RRC*  *Phy-ParametersCommon* | No | No | RAN1 kindly requests RAN2 to decide on the necessity 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 |
|  | 13-10 | 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 | *LPP*  *spatialRelation-SRS-PosBasedOnSSB-Serving-r16*  *RRC*  *spatialRelation-SRS-PosBasedOnSSB-Serving-r16* | *LPP*  *SpatialRelationsSRS-Pos-r16*  *RRC*  *SpatialRelationsSRS-Pos-r16* | n/a | n/a (FR2 only) | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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 | *LPP*  *spatialRelation-SRS-PosBasedOnCSI-RS-Serving-r16*  *RRC*  *spatialRelation-SRS-PosBasedOnCSI-RS-Serving-r16* | *LPP*  *SpatialRelationsSRS-Pos-r16*  *RRC*  *SpatialRelationsSRS-Pos-r16* | n/a | n/a (FR2 only) | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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 | *LPP*  *spatialRelation-SRS-PosBasedOnPRS-Serving-r16*  *RRC*  *spatialRelation-SRS-PosBasedOnPRS-Serving-r16* | *LPP*  *SpatialRelationsSRS-Pos-r16*  *RRC*  *SpatialRelationsSRS-Pos-r16* | n/a | n/a (FR2 only) | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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, | *LPP*  *spatialRelation-SRS-PosBasedOnSRS-r16*  *RRC*  *spatialRelation-SRS-PosBasedOnSRS-r16* | *LPP*  *SpatialRelationsSRS-Pos-r16*  *RRC*  *SpatialRelationsSRS-Pos-r16* | n/a | n/a (FR2 only) | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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 | *LPP*  *spatialRelation-SRS-PosBasedOnSSB-Neigh-r16*  *RRC*  *spatialRelation-SRS-PosBasedOnSSB-Neigh-r16* | *LPP*  *SpatialRelationsSRS-Pos-r16*  *RRC*  *SpatialRelationsSRS-Pos-r16* | n/a | n/a (FR2 only) | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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  Note: A PRS from a PRS-only TP is treated as PRS from a non-serving cell | 13-10b | *LPP*  *spatialRelation-SRS-PosBasedOnPRS-Neigh-r16*  *RRC*  *spatialRelation-SRS-PosBasedOnPRS-Neigh-r16* | *LPP*  *SpatialRelationsSRS-Pos-r16*  *RRC*  *SpatialRelationsSRS-Pos-r16* | n/a | n/a (FR2 only) | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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} | *LPP*  *maxNumberSRS-PosSpatialRelationsAllServingCells-r16*  *RRC*  *maxNumberSRS-PosSpatialRelationsAllServingCells-r16* | *LPP*  *NR-UL-SRS-Capability-r16*  *RRC*  *Phy-ParametersFR2* | No | No (FR2 only) | 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 |
|  | 13-11a | Association between SRS for positioning and DL PRS 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 | *LPP*  *srs-AssocPRS-MultiLayersFR1-r16*  *srs-AssocPRS-MultiLayersFR2-r16* | *LPP*  *NR-Multi-RTT-MeasurementCapability-r16* | No | Yes | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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  2. 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 | *LPP*  *1 maxNrOfRx-TX-MeasFR1-r16*  *maxNrOfRx-TX-MeasFR2-r16*  *2 supportOfRSRP-MeasFR1-r16*  *supportOfRSRP-MeasFR2-r16* | *LPP*  *NR-Multi-RTT-MeasurementCapability-r16* | No | Yes | 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 |
|  | 13-12 | SS-RSRP RRM measurements for NR E-CID Positioning | 1. Support of cell-specific SS-RSRP RRM measurements with LPP report for NR E-CID Positioning  2. Support of beam-specific SS-RSRP RRM measurements with LPP report for NR E-CID Positioning | 1-1 | *nr-ECID-MeasSupported-r16 BIT STRING { ssrsrpSup(0),*  *ssrsrqSup(1),*  *csirsrpSup(2),*  *csirsrqSup(3)} (SIZE(1..8))* | *NR-ECID-ProvideCapabilities-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 13-12a | SS-RSRQ RRM measurements for NR E-CID Positioning | 1. Support of cell-specific SS-RSRQ RRM measurements with LPP report for NR E-CID Positioning  2. Support of beam-specific SS-RSRQ RRM measurements with LPP report for NR E-CID Positioning | 1-1 | *nr-ECID-MeasSupported-r16 BIT STRING { ssrsrpSup(0),*  *ssrsrqSup(1),*  *csirsrpSup(2),*  *csirsrqSup(3)} (SIZE(1..8))* | *NR-ECID-ProvideCapabilities-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 13-12b | CSI-RSRP RRM measurements for NR E-CID Positioning | 1. Support of cell-specific CSI-RSRP RRM measurements with LPP report for NR E-CID Positioning  2. Support of beam-specific CSI-RSRP RRM measurements with LPP report for NR E-CID Positioning | 1-4 | *nr-ECID-MeasSupported-r16 BIT STRING { ssrsrpSup(0),*  *ssrsrqSup(1),*  *csirsrpSup(2),*  *csirsrqSup(3)} (SIZE(1..8))* | *NR-ECID-ProvideCapabilities-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 13-12c | CSI-RSRQ RRM measurements for NR E-CID Positioning | 1. Support of cell-specific CSI-RSRQ RRM measurements with LPP report for NR E-CID Positioning  2. Support of beam-specific CSI-RSRQ RRM measurements with LPP report for NR E-CID Positioning | 1-4 | *nr-ECID-MeasSupported-r16 BIT STRING { ssrsrpSup(0),*  *ssrsrqSup(1),*  *csirsrpSup(2),*  *csirsrqSup(3)} (SIZE(1..8))* | *NR-ECID-ProvideCapabilities-r16*  *LPP* | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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 | *simul-NR-DL-AoD-DL-TDOA-r16* | *DL-AoD-MeasCapabilityPerBand*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 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 | *simul-NR-DL-AoD-Multi-RTT-r16* | *DL-AoD-MeasCapabilityPerBand*  *LPP* | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  | 13-15 | Simultaneous SRS transmission within a band across multiple CCs | 1. The number of SRS resources for positioning on a symbol within a band  Candidate values {2}  Note: if the UE does not indicate this capability for a band, the UE does not support the feature in this band | 13-8 | *RRC*  *simulSRS-TransWithinBand-r16* | *RRC*  *BandNR* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported | Optional with capability signaling |
|  | 13-15a | Simultaneous SRS transmission for a given BC | 1. The number of SRS resources for positioning on a symbol for a given BC  Candidate values {2}  Note: For single-band BCs, it defines the capability for intra-band CA, and for BCs with at least two bands, it defines the capability for inter-band CA.  Note: if the UE does not indicate this capability for a band combination, the UE does not support the feature in this band combination | 13-8 | *RRC*  *simul-SRS-Trans-BC-r16* | *RRC*  *CA-ParametersNR-v1610* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported | Optional with capability signaling |
|  | 13-18 | Support of parallel processing of LTE PRS and NR PRS | 1. Support of parallel processing of LTE PRS and NR PRS |  | *simulLTE-NR-PRS-r16* | *NR-DL-PRS-ProcessingCapability-r16*  *LPP* | No | No | Need for location server to know if the feature is supported | Optional with capability signaling |
|  | 13-19 | Simultaneous positioning SRS and MIMO SRS transmission within a band across multiple CCs | 1. The number of SRS resources for positioning and SRS resource for MIMO on a symbol within a band  Candidate values {2}  Note: SRS resource for MIMO refers to SRS resource configured by SRS-Resource.  Note: If UE reports 2 for the candidate value, it means both the number of SRS resource for positioning and SRS resource for MIMO equals to 1.  Note: if the UE does not indicate this capability for a band, the UE does not support the feature in this band | 13-8 | *RRC*  *simulSRS-MIMO-TransWithinBand-r16* | *RRC*  *BandNR* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported | Optional with capability signaling |
|  | 13-19a | Simultaneous positioning SRS and MIMO SRS transmission for a given BC | 1. The number of SRS resources for positioning and SRS resource for MIMO on a symbol for a given BC  Candidate values {2}  Note: SRS resource for MIMO refers to SRS resource configured by SRS-Resource.  Note: If UE reports 2 for the candidate value, it means both the number of SRS resource for positioning and SRS resource for MIMO equals to 1.  Note: For single-band BCs, it defines the capability for intra-band CA, and for BCs with at least two bands, it defines the capability for inter-band CA.  Note: if the UE does not indicate this capability for a band combination, the UE does not support the feature in this band combination | 13-8 | *RRC*  *simul-SRS-MIMO-Trans-BC-r16* | *RRC*  *CA-ParametersNR-v1610* | n/a | n/a | RAN1 kindly requests RAN2 to decide on the necessity for location server to know if the feature is supported | Optional with capability signaling |

END OF 2nd CHANGE

START OF 3rd CHANGE

### 5.1.12 NR\_IAB

Table 5.1.12-1: Layer-1 feature list for NR\_IAB

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Field name in TS 38.331 [2] | Parent IE in TS 38.331 [2] | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Note | Mandatory/Optional |
| 20. NR\_IAB | 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 |  | *seperateSMTC-InterIAB-Support-r16* | *Phy-ParametersCommon* | No | No | IAB-MT impact | Mandatory with capability signalling |
| 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 |  | *seperateRACH-IAB-Support-r16* | *Phy-ParametersCommon* | No | No | IAB-MT impact | Optional with capability signalling |
| 20-5a | UL-Flexible-DL slot formats | Support semi-static configuration/indication of UL-Flexible-DL slot formats for IAB-MT resources | 5-1a | *ul-flexibleDL-SlotFormatSemiStatic-IAB-r16* | *Phy-ParametersCommon* | No | No | 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 | *ul-flexibleDL-SlotFormatDynamics-IAB-r16* | *Phy-ParametersCommon* | No | No | 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 |  | *dci-25-AI-RNTI-Support-IAB-r16* | *Phy-ParametersCommon* | No | No | IAB-MT impact | Optional with capability signalling. |
| 20-7 | Case 1 OTA timing alignment | Support T\_delta reception. |  | *t-DeltaReceptionSupport-IAB-r16* | *Phy-ParametersCommon* | No | No | IAB-MT impact | Optional with capability signalling. |
| 20-8 | Guard symbols | 1) Support DesiredGuardSymbols reporting  2) Support ProvidedGuardSymbols reception |  | *guardSymbolReportReception-IAB-r16* | *Phy-ParametersCommon* | No | No | IAB-MT impact | Optional with capability signalling. |

END OF 3rd CHANGE

START OF 4th CHANGE

### 5.3.12 Others

Table 5.3.12-1: Others

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Field name in TS 38.331 [2] | Parent IE in TS 38.331 [2] | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Note | Mandatory/Optional |
| UE RF | 2-18 | Maximum uplink duty cycle for TDD+TDD EN-DC power class 2 *(maxUplinkDutyCycle-interBandENDC-TDD-PC2-r16)* | Indicates the maximum percentage of symbols during a certain evaluation period that can be scheduled for NR uplink transmission under different EUTRA TDD uplink-downlink configurations so as to ensure compliance with applicable electromagnetic energy absorption requirements provided by regulatory bodies. This field is only applicable for inter-band TDD+TDD EN-DC power class 2 UE as specified in TS 38.101-3. If the field is absent, 30% shall be applied to all EUTRA TDD uplink-downlink configurations. If eutra-TDD-Configx is absent, 30% shall be applied to the corresponding EUTRA TDD uplink-downlink configuration.  Value n20 corresponds to 20%, value n40 corresponds to 40% and so on. |  | *maxUplinkDutyCycle-interBandENDC-TDD-PC2-r16*  *{*  *eutra-TDD-Config0-r16,*  *eutra-TDD-Config1-r16,*  *eutra-TDD-Config2-r16,*  *eutra-TDD-Config3-r16,*  *eutra-TDD-Config4-r16,*  *eutra-TDD-Config5-r16,*  *eutra-TDD-Config6-r16*  *}* | *MRDC-Parameters-v1620* | TDD only | FR1 only |  | Optional with capability signalling |
| 2-19 | FDD-FDD or TDD-TDD inter-band MR-DC with overlapping or partially overlapping DL spectrum | Type 1 UE: supports FDD-FDD or TDD-TDD inter-band operation with overlapping or partially DL bands with MRTD<3us and intra-band MR-DC requirements apply.  Type 2 UE: supports FDD-FDD or TDD-TDD inter-band operation with overlapping or partially overlapping DL bands with an MR-DC MRTD according to clause 7.6.2 in 38.133 and applicable inter-band RF requirements.  If absent the UE is a type 1 UE. |  | *interBandMRDC-WithOverlapDL-Bands-r16* | *MRDC-Parameters-v1630* | n/a | FR1 only |  | Optional with capability signalling |
| 2-20 | Maximum uplink duty cycle for FDD+TDD EN-DC power class 2 | The maximum percentage of symbols during a certain evaluation period that can be scheduled for NR uplink transmission and EUTRA FDD uplink transmission so as to ensure compliance with applicable electromagnetic energy absorption requirements provided by regulatory bodies for FDD+TDD EN-DC power class 2 UE. |  | *maxUplinkDutyCycle-interBandENDC-FDD-TDD-PC2-r16 {*  *maxUplinkDutyCycle-FDD-TDD-EN-DC1-r16,*  *maxUplinkDutyCycle-FDD-TDD-EN-DC2-r16*  *}* | *MRDC-Parameters-v1630* | n/a | FR1 only | Introduce 2 UE capabilities of *maxUplinkDutyCycle-FDD&TDD-EN-DC1* and *maxUplinkDutyCycle-FDD&TDD-EN-DC2* which indicate the maxUplinkDutyCycle capability of NR band corresponding to different LTE reference configurations as described in TS 38.101-3 clause 6.2B.1.3.  The value range is as below:  - maxUplinkDutyCycle-FDD&TDD-EN-DC1, maxUplinkDutyCycle-FDD&TDD-EN-DC2 ∈ {30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%}  This field is only applicable for inter-band FDD+TDD EN-DC power class 2 UE as specified in TS 38.101-3. | Optional with capability signalling |
|  | 2-21 | Transparent Tx Diversity | Indicates whether the UE supports Tx diversity requirements as specified in TS 38.101-1. The capability applies to all power classes equally in all the applicable releases via a release independent manner. |  | *txDiversity-r16* | *BandNR* | n/a | FR1 only |  | Optional with capability signalling |
|  | 2-22 (RAN2) |  | Indicates power class 1.5 the UE supports when operating according to this band combination. If the field is absent, the UE supports the default power class. If this power class is higher than the power class that the UE supports on the individual bands of this band combination *(ue-PowerClass in BandNR*), the latter determines maximum TX power available in each band. |  | *(1) powerClass-v1610*  *(2) ue-powerClass-v1610* | *(1) BandCombination-v1610*  *(2) BandNR* | N/A | FR1 only |  | Optional with capability signalling |
|  | 2-23 (RAN 2) |  | Indicates NR part power class the UE supports when operating according to this band combination.  This field only applies for MR-DC BCs containing only single CC or intra-band CA in NR side in this release. |  | *powerClassNRPart-r16* | *BandCombination-v1610* | N/A | FR1 only |  | Optional with capability signalling |

END OF 4th CHANGE