**3GPP TSG RAN WG1 #119 R1-24nnnnn**

**Orlando, US, November 18th – 22nd, 2024**

**Source: Ad-Hoc Chair (AT&T)**

**Title: Session Notes of AI 9.14.2**

**Agenda Item: 9.14.2**

**Document for: Endorsement**

### 9.14.2 UE features for NR MIMO Phase 5

*For RAN1#119, in addition to individual company/organization/university tdocs, the rapporteurs are to provide initial input on UE features for Rel-19 MIMO.*

**Agreement: Introduce the following Rel. 19 UE FGs (yellow highlighting, if any, shows text that’s not yet agreed)**

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| 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 (Sidelink 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 |
| 59. NR\_MIMO\_Ph5 | 59-1-1 | UE-initiated/event-driven beam management [at least] for Mode A | 1. Support of UE-initiated/event-driven beam report based on one event instance [with M=1]  2. Support of Event-2 based measurement and report  3. Support of Mode A UE-initiated/event-driven beam report  [4. Maximum number of the configured RS(s) for new beam in the RS resource set]  [5. Support of current beam measurement by using QCL RS in the indicated TCI state and the corresponding QCL SSB for Scheme-1 and Scheme-2, respectively] | FFS | yes | n/a | UEI/ED beam report is not supported [for Event-2 and Mode A] | FFS | FFS | FFS | FFS | [Component 4 candidate values: {1, 2, … , 64}]  FFS: Further partitioning of this FG based one existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | [1.Support of UE-initiated/event-driven beam report [based on one event instance]]  [2. Support of Event-2 based measurement and report]  3. Support of Mode B UE-initiated/event-driven beam report  [4. Maximum number of the configured RS(s) for new beam in the RS resource set]  [5. Support of current beam measurement by using QCL RS in the indicated TCI state and the corresponding QCL SSB for Scheme-1 and Scheme-2, respectively]  [6. Supported values of X] | FFS | yes | n/a | UEI/ED beam report Mode-B is not supported for Event | FFS | FFS | FFS | FFS | [Component 2 candidate values: {0,1,…,[N]}]  FFS: whether to combine FG 59-1-1 and FG 59-1-2  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances within a time window. | Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) within a time window [with M>1 per one new beam] | FFS | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | FFS | FFS | FFS | FFS | FFS: whether to merge FG 59-1-1 and FG 59-1-3  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |

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| **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 (Sidelink 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** |
| 59. NR\_MIMO\_Ph5 | 59-2-2-1 | Hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | [1. M={1,2,3,4}]  [2. KS={1,2, …, 8}] | FFS | yes | n/a | Hybrid BF (CRI-based) with Rel-15 Type-I SP codebook is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-2-2 | Hybrid BF (CRI-based) with Rel-16 eType-II codebook | [1. M={1,2}]  [2. KS={1,2,3,4}] | FFS | yes | n/a | Hybrid BF (CRI-based) with Rel-16 eType-II codebook is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-2-3 | Configuration of MR always-reported resources | [1. For Rel-15 Type-I SP, MR={1,2}]  [2. For Rel-16 eType-II, MR={1}] | FFS | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |

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| **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 (Sidelink 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** |
| 59. NR\_MIMO\_Ph5 | 59-2-3-1 | CJTC Dd report | [1. AD={0.5CP, CP}]  [2. MD={32, 64, 128, 256}] | FFS | yes | n/a | CJTC Dd report is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-2 | CJTC FO report | [1. AF={0.1ppm, 0.2ppm}]  [2. MF={16, 32, 256}] | FFS | yes | n/a | CJTC FO report is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-3 | CJTC wideband PO report | [1. Mphi= {16, 32}] | FFS | yes | n/a | CJTC PO report is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-4 | CJTC subband PO report | [1. Mphi= {16, 32}]  [2. Subband size= {1, 2, 4, 8, 16} RB] | FFS | yes | n/a | CJTC subband PO report is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-5 | CJTC Dd+FO report | [1. AD={0.5CP, CP}]  [2. MD={32, 64, 128, 256}]  [3. AF={0.1ppm, 0.2ppm}]  [4. MF={16, 32, 256}] | FFS | yes | n/a | CJTC Dd+FO report is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-6 | New CJT QCL assumptions for PDSCH pre-compensation | [1. Scheme-C]  [2. Scheme-D]  [3. Scheme-E] | FFS | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT | [1. Joint triggering]  [2. Separate triggering w/o delay offset compensation (DOC) indication]  [3. Separate triggering w/ delay offset compensation (DOC) indication] | FFS | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | FFS | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-1 | Enhanced Type-I SP codebook | [Support of enhanced Type-I SP codebook] | FFS | yes | n/a | Enhanced Type-I SP codebook is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …) | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-2 | Enhanced Type-I MP codebook | [Support of enhanced Type-I MP codebook] | FFS | yes | n/a | Enhanced Type-I MP codebook is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …) | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-3 | Extended Rel-16 eType-II codebook | [Support of extended Rel-16 eType-II codebook] | FFS | yes | n/a | Extended Rel-16 eType-II codebook is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …) | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-4 | Extended Rel-17 FeType-II codebook | [Support of extended Rel-17 FeType-II codebook] | FFS | yes | n/a | Extended Rel-17 FeType-II codebook is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …) | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5 | Extended Rel-18 eType-II Doppler codebook | [Support of extended Rel-18 Type-II Doppler codebook] | FFS | yes | n/a | Extended Rel-18 Type-II Doppler codebook is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …) | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource slot offset configuration [for periodic [and/or] aperiodic CSI-RS] | [Support of 2-slot CSI-RS resource aggregation] | FFS | yes | n/a | 2-slot resource aggregation is not supported | FFS | FFS | FFS | FFS | [1-slot resource aggregation is a basic feature and incorporated in 59-2-1-1, 2, 3, 4, 5] | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-7 | Group-specific 3-bit scaling factors for up to 128 ports | Support of group-specific 3-bit scaling factors | FFS | yes | n/a | Group-specific 3-bit scaling factors is not supported | FFS | FFS | FFS | FFS | [Candidate values: {’rank 1’, ‘rank 1 and 2’}]  Note: 3-bit scaling applies only to the Type-I SP codebook  FFS: Further partitioning of this FG based on existing and future agreements, e.g., separate FGs for RI=1 and RI=2 | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | FFS | yes | n/a | SRS Port Grouping is not supported | FFS | FFS | FFS | FFS | [Only applicable for reportQuantity = ‘cri-RI-CQI’]  FFS: Further partitioning of this FG based on existing and future agreements, e.g., separate SRS port group for xT6R and xT8R related SRS antenna switching | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-3-1 | Non-codebook based PUSCH transmission for 3TX for single TRP | 1. Maximal number of supported layers (non-codebook transmission scheme)  [2. Maximum number of SRS resource per set (SRS set use is configured as for non-codebook transmission)]  [3. Maximum number of simultaneous transmitted SRS resources at one symbol]  [4. Association between CSI-RS and SRS for non-codebook-based 3Tx PUSCH] | FFS | yes | n/a | Non-codebook based PUSCH transmission for 3TX is not supported | FFS | FFS | FFS | FFS | [Component 1 candidate values: {1, 2, 3}]  [Component 2 candidate values: {1,2,3}]  [Component 3 candidate values: {1,2,3}]  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-3-2 | Codebook based PUSCH transmission for 3TX for single TRP | 1. Maximal number of PUSCH MIMO layers for codebook-based PUSCH  2. Maximum number of 4-port SRS resources per SRS resource set with usage set to 'codebook’ for codebook-based 3Tx PUSCH  [3. Maximum number of simultaneous transmitted SRS resources at one symbol with usage set to 'codebook’ for codebook-based 3Tx PUSCH]  4. Codebook based PUSCH transmission with port 1003 disabled when 4 port SRS resources with port 1003 disabled are configured to the UE | FFS | yes | n/a | Codebook based PUSCH transmission for 3TX is not supported | FFS | FFS | FFS | FFS | [Component 1 candidate values: {1, 2,3}]  [Component 2 candidate values: {1,2}]  [Component 3 candidate values: {1,2,3}]  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-3-3 | 3T6R Antenna switching | 1. Support of 3T6R SRS Tx port switching [with port 1003 disabled when 4 port SRS resources with port 1003 disabled are configured to the UE]  [2. Support of reporting whether the uplink TX switching impact to downlink receiving in a band]  [3. Support of reporting whether the UL Tx is switched together with UL Tx in another band]  [4. Maximum 2 SP and 1 periodic SRS sets for 3T6R antenna switching] | FFS | yes | n/a | 3TX 3T6R antenna switching is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-3-3a | 3T3R antenna switching | 1. Support of 3T3R SRS Tx port switching [with port 1003 disabled when 4 port SRS resources with port 1003 disabled are configured to the UE]  [2. Support of reporting whether the uplink TX switching impact to downlink receiving in a band]  [3. Support of reporting whether the UL Tx is switched together with UL Tx in another band]  [4. Maximum 2 SP and 1 periodic SRS sets for 3T3R antenna switching] | FFS | yes | n/a | 3TX 3T3R antenna switching is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| NR MIMO Phase 5 | 59-3-4 | M-TRP PUSCH repetition (type A) of 3-antenna-port PUSCH transmission – codebook based | 1. Support of M-TRP PUSCH repetition for 3-antenna-port PUSCH transmission with type A for codebook based  - sequential mapping for repetitions larger than 2  [- cyclic mapping for 2 repetitions]  2. Support of two SRS resource sets with usage set to 'codebook'  3. Supported number of SRS resources in one SRS resource set | FFS | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type A for codebook based | FFS | FFS | FFS | FFS | [Component 3 candidate values: {1,2}]  Note: Two linked PDCCH candidates are not expected to be associated with different CORESETPoolIndex values  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| NR MIMO Phase 5 | 59-3-4a | M-TRP PUSCH repetition (type A) of 3-antenna-port PUSCH transmission – non-codebook based | Support of M-TRP PUSCH repetition for 3-antenna-port PUSCH transmission with type A for non-codebook based  - sequential mapping for repetitions larger than 2  [- cyclic mapping for 2 repetitions]  2. Support of two SRS resource sets with usage set to 'non-codebook'  3. Supported number of SRS resources in one SRS resource set | FFS | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type A for non-codebook based | FFS | FFS | FFS | FFS | [Component 3 candidate values: {1,2,3.4}]  Note: Two linked PDCCH candidates are not expected to be associated with different CORESETPoolIndex values  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| NR MIMO Phase 5 | 59-3-5 | M-TRP PUSCH repetition (type B) of 3-antenna-port PUSCH transmission – codebook based | Support of M-TRP PUSCH repetition for 3-antenna-port PUSCH transmission with type B for codebook based  - sequential mapping for repetitions larger than 2  [- cyclic mapping for 2 repetitions]  2. Support of two SRS resource sets with usage set to 'codebook'  3. Supported number of SRS resources in one SRS resource set | FFS | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type B for codebook based | FFS | FFS | FFS | FFS | [Component 3 candidate values: {1,2}]  Note: Two linked PDCCH candidates are not expected to be associated with different CORESETPoolIndex values  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| NR MIMO Phase 5 | 59-3-5a | M-TRP PUSCH repetition (type B) of 3-antenna-port PUSCH transmission – non-codebook based | Support of M-TRP PUSCH repetition for 3-antenna-port PUSCH transmission with type B for non-codebook based  - sequential mapping for repetitions larger than 2  [- cyclic mapping for 2 repetitions]  2. Support of two SRS resource sets with usage set to 'non-codebook'  3. Supported number of SRS resources in one SRS resource set | FFS | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type B for non-codebook based | FFS | FFS | FFS | FFS | [Component 3 candidate values: {1,2,3,4}]  Note: Two linked PDCCH candidates are not expected to be associated with different CORESETPoolIndex values  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| NR MIMO Phase 5 | 59-3-6 | PTRS of 3-antenna-port PUSCH transmission | Number of supported PTRS ports for PUSCH transmission | [59-3-1 or] 59-3-2 | yes | n/a | PTRS is not supported for 3TX PUSCH transmission | FFS | FFS | FFS | FFS | [Candidate values: {1,2}] | Optional with capability signalling |
| NR MIMO Phase 5 | 59-3-7 | Support of full-power Mode 0 for codebook-based for 3 Tx operation | UL full power transmission mode of *fullpower* | 59-3-2 | yes | n/a | UL full power transmission mode of *fullpower* is not supported for 3 Tx operation | FFS | FFS | FFS | FFS | Note: If a UE does not support this FG, Rel. 15 power scaling procedures apply  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |

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| **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 (Sidelink 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** |
| 59. NR\_MIMO\_Ph5 | 59-4-1 | PL offset for PUCCH/PUSCH/SRS power control | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls | FFS | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., joint DL/UL TCI(s) and separate UL TCI(s)) | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-2 | Path Loss offset on PDCCH-order PRACH | Support of applying path loss offset on PDCCH-order PRACH | FFS | yes | n/a | Applying path loss offset on PDCCH-order PRACH is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-3 | Two SRS closed-loop power control adjustment states separatefrom PUSCH ~~SRS closed loop indices~~ | Support of two separate SRS closed loop indices separate from PUSCH | FFS | yes | n/a | Two separate SRS closed loop indexes is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-4 | Support two TAs enhancement | Support of two TAs without the restriction of multi-DCI based multi-TRP operation | FFS | yes | n/a | Two TAs without the restriction of multi-DCI based multi-TRP operation is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | FFS | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | FFS | FFS | FFS | FFS | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap ~~(i.e., scheduling restriction is applied to avoid overlap between the two UL transmissions)~~  FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | FFS | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-7 | Extended value range of starting bit of block in DCI format 2\_3 | Support of the extended value range of starting bit of DCI format 2\_3 | FFS | yes | n/a | The extended value range of starting bit of DCI format 2\_3 is not supported | FFS | FFS | FFS | FFS | Note: The starting bit of value range extends to X=45 for operations in FR1 in shared spectrum or FR2-2 and X = 43 otherwise  FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) | Support of DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) | FFS | yes | n/a | DCI 1\_1 indicating TPC command for separate SRS closed loop index(es) is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) and also whether to have one FG is “DCI format 1\_1 for TPC command indicatinon for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states” | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-1 | Enhanced Type-I SP codebook – Scheme-A | 1. Support of enhanced Type-I SP codebook for Scheme-A  2. A list of supported combinations, up to 16, across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously, where each combination is  a) Maximum number of Tx ports in one NZP CSI-RS resource  b) Maximum total number of NZP CSI-RS resources aggregated  c) Maximum total number of Tx ports of aggregated NZP CSI-RS resources  3. Supported ranks | FFS | yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-A | FFS | FFS | FFS | FFS | Component 2 candidate values:  a) {16, 32}  b) {2, 4}  c) {64}  Component 3 candidate values: {1,2,3,4}  ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …)~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-1 | Enhanced Type-I SP codebook – Scheme-B | 1. Support of enhanced Type-I SP codebook for Scheme-B  2. A list of supported combinations, up to 16, across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously, where each combination is  a) Maximum number of Tx ports in one NZP CSI-RS resource  b) Maximum total number of NZP CSI-RS resources aggregated  c) Maximum total number of Tx ports of aggregated NZP CSI-RS resources  3. Supported ranks | FFS | yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-B | FFS | FFS | FFS | FFS | Component 2 candidate values:  a) {16, 32}  b) {2, 4}  c) {64}  Component 3 candidate values: {1,2,3,4} | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-2 | Enhanced Type-I MP codebook – Scheme-A | [Support of enhanced Type-I MP codebook for Scheme-A] | FFS | yes | n/a | Enhanced Type-I MP codebook is not supported for Scheme-A | FFS | FFS | FFS | FFS | ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …)~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-2a | Enhanced Type-I MP codebook – Scheme-B | [Support of enhanced Type-I MP codebook for Scheme-B] | FFS | yes | n/a | Enhanced Type-I MP codebook is not supported for Scheme-B | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-3 | Extended Rel-16 eType-II codebook – Scheme-A | [Support of extended Rel-16 eType-II codebook for Scheme-A] | FFS | yes | n/a | Extended Rel-16 eType-II codebook is not supported for Scheme-A | FFS | FFS | FFS | FFS | ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …)~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-3a | Extended Rel-16 eType-II codebook – Scheme-B | [Support of extended Rel-16 eType-II codebook for Scheme-B] | FFS | yes | n/a | Extended Rel-16 eType-II codebook is not supported for Scheme-B | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-4 | Extended Rel-17 FeType-II codebook – Scheme-A | [Support of extended Rel-17 FeType-II codebook for Scheme-A] | FFS | yes | n/a | Extended Rel-17 FeType-II codebook is not supported for Scheme-A | FFS | FFS | FFS | FFS | ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …)~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-4a | Extended Rel-17 FeType-II codebook – Scheme-B | [Support of extended Rel-17 FeType-II codebook for Scheme-B] | FFS | yes | n/a | Extended Rel-17 FeType-II codebook is not supported for Scheme-B | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-5 | Extended Rel-18 eType-II Doppler codebook – Scheme-A | [Support of extended Rel-18 Type-II Doppler codebook for Scheme-A] | FFS | yes | n/a | Extended Rel-18 Type-II Doppler codebook is not supported for Scheme-A | FFS | FFS | FFS | FFS | ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., Scheme-A and Scheme-B separation, number of ports, …)~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5a | Extended Rel-18 eType-II Doppler codebook – Scheme-B | [Support of extended Rel-18 Type-II Doppler codebook for Scheme-B] | FFS | yes | n/a | Extended Rel-18 Type-II Doppler codebook is not supported for Scheme-B | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-7 | Group-specific 3-bit scaling factors for up to 128 ports | Support of group-specific 3-bit scaling factors | FFS | yes | n/a | Group-specific 3-bit scaling factors is not supported | FFS | FFS | FFS | FFS | ~~[~~Candidate values: {’rank 1’, ‘rank 1 and 2’}~~]~~  Note: 3-bit scaling applies only to the Type-I SP codebook  ~~FFS: Further partitioning of this FG based on existing and future agreements, e.g., separate FGs for RI=1 and RI=2~~ | Optional with capability signalling |

* **Alt. 2**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-7 | Group-specific 3-bit scaling factors for up to 128 ports for rank 1 | Support of group-specific 3-bit scaling factors for rank 1 | FFS | yes | n/a | Group-specific 3-bit scaling factors is not supported for rank 1 | FFS | FFS | FFS | FFS | ~~[Candidate values: {’rank 1’, ‘rank 1 and 2’}]~~  Note: 3-bit scaling applies only to the Type-I SP codebook  ~~FFS: Further partitioning of this FG based on existing and future agreements, e.g., separate FGs for RI=1 and RI=2~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-7a | Group-specific 3-bit scaling factors for up to 128 ports for rank 2 | Support of group-specific 3-bit scaling factors for rank 2 | FFS | yes | n/a | Group-specific 3-bit scaling factors is not supported for rank 2 | FFS | FFS | FFS | FFS | Note: 3-bit scaling applies only to the Type-I SP codebook | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | FFS | yes | n/a | SRS Port Grouping is not supported | FFS | FFS | FFS | FFS | [Only applicable for reportQuantity = ‘cri-RI-CQI’]  ~~FFS: Further partitioning of this FG based on existing and future agreements, e.g., separate SRS port group for xT6R and xT8R related SRS antenna switching~~ | Optional with capability signalling |

* **Alt. 2**

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| 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping for xT6R | Support of SRS port grouping for xT6R | FFS | yes | n/a | SRS Port Grouping is not supported for xT6R | FFS | FFS | FFS | FFS | [Only applicable for reportQuantity = ‘cri-RI-CQI’]  ~~FFS: Further partitioning of this FG based on existing and future agreements, e.g., separate SRS port group for xT6R and xT8R related SRS antenna switching~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-8a | SRS Port Grouping for xT8R | Support of SRS port grouping for xT8R | FFS | yes | n/a | SRS Port Grouping is not supported for xT8R | FFS | FFS | FFS | FFS | [Only applicable for reportQuantity = ‘cri-RI-CQI’] | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 59. NR\_MIMO\_Ph5 | 59-4-1 | PL offset for PUCCH/PUSCH/SRS power control | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls | FFS | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control is not supported | FFS | FFS | FFS | FFS | ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., joint DL/UL TCI(s) and separate UL TCI(s))~~ | Optional with capability signalling |

* **Alt. 2**

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| 59. NR\_MIMO\_Ph5 | 59-4-1 | PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for joint DL/UL TCI(s) | FFS | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control is not supported for joint DL/UL TCI(s) | FFS | FFS | FFS | FFS | ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., joint DL/UL TCI(s) and separate UL TCI(s))~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-1a | PL offset for PUCCH/PUSCH/SRS power control for separate UL TCI(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for separate UL TCI(s) | FFS | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control is not supported for separate UL TCI(s) | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

* **Alt. 1**

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| 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) | Support of DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) | FFS | yes | n/a | DCI 1\_1 indicating TPC command for separate SRS closed loop index(es) is not supported | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) ~~and also whether to have one FG is “DCI format 1\_1 for TPC command indicatinon for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states”~~ | Optional with capability signalling |

* **Alt. 2**

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| 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) for one separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) for one separate SRS CLPC adjustment state | FFS | yes | n/a | DCI 1\_1 indicating TPC command for separate SRS closed loop index(es) is not supported for one separate SRS CLPC adjustment state | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) ~~and also whether to have one FG is “DCI format 1\_1 for TPC command indicatinon for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states”~~ | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-8a | DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) for two separate SRS CLPC adjustment states | Support of DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) for two separate SRS CLPC adjustment states | FFS | yes | n/a | DCI 1\_1 indicating TPC command for separate SRS closed loop index(es) is not supported for two separate SRS CLPC adjustment states | FFS | FFS | FFS | FFS | FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) | Optional with capability signalling |

**Proposal:**

* **Introduce a new row/FG for signalling support of asymmetric DL sTRP/UL mTRP**
* **This new FG becomes a prerequisite for all FGs currently having the following FFS: “Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios)”**
* **The FFS “Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios)” is removed from all FGs**

R1-2409382 Discussion on UE features for NR MIMO Phase 5 ZTE Corporation, Sanechips

R1-2409431 UE features for NR MIMO Phase 5 Huawei, HiSilicon

R1-2409533 "Discussion on UE features for NR MIMO Phase 5" CMCC

R1-2409620 UE features for NR MIMO Phase 5 Samsung

R1-2409621 Initial list of UE features for Rel-19 MIMO Ph5 Samsung (Moderator)

R1-2409704 Discussion on Rel-19 MIMO UE features vivo

R1-2409768 Initial views on UE features NR MIMO Phase 5 WI Nokia

R1-2409829 Views on UE features for NR MIMO Phase 5 Apple

R1-2409932 On UE features for NR MIMO Phase 5 CATT

R1-2410112 UE features for NR MIMO Phase 5 OPPO

R1-2410342 UE features for NR MIMO Phase 5 Ericsson

R1-2410501 UE features for NR MIMO phase 5 Qualcomm Incorporated