**3GPP TSG RAN WG1 #122bis R1-25nnnnn**

**Prague, Czech Republic, October 13th –17th, 2025**

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

**Title: Session Notes of AI 9.2**

**Agenda Item: 9.2**

**Document for: Endorsement**

### 9.2 UE features for NR MIMO Phase 5

**Agreement: 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 for 64 ports – Scheme-A | 1. Support of enhanced Type-I SP codebook for Scheme-A with 64 Tx ports by aggregating multiple NZP CSI-RS resourceswithin one slot2. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum rank4. Max # of CSI-RS resource in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 2-35 | yes | n/a | Enhanced Type-I SP codebook is not supported for 64 ports – Scheme-A, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {4, 5, 6, 7, 8}Component 4 candidate value {2,4}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-1a | Enhanced Type-I SP codebook for 48 ports – Scheme-A | 1. Support of enhanced Type-I SP codebook for Scheme-A with 48 Tx ports by aggregating multiple NZP CSI-RS resources within one slot2. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum rank4. Max # of CSI-RS resource in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-1 | yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-A for 48 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {4, 5, 6, 7, 8}Component 4 candidate value {~~1:8~~2,3}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-1b | Enhanced Type-I SP codebook for 128 ports – Scheme-A | 1. Support of enhanced Type-I SP codebook for Scheme-A with 128 Tx ports by aggregating multiple NZP CSI-RS resources within one slot2. A list of supported combinations, each combination is Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum rank4. Support 4 CSI-RS resources in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-1 | yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-A for 128 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {4, 5, 6, 7, 8}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-1c | Enhanced Type-I SP codebook for 64 ports – Scheme-B | 1. Support of enhanced Type-I SP codebook for Scheme-B with 64 Tx ports by aggregating multiple NZP CSI-RS resources within one slot2. A list of supported combinations, each combination is Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum rank4. Max # of CSI-RS resource in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 2-35 | yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-B for 64 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {4, 5, 6, 7, 8}Component 4 candidate value {2,4}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-1d | Enhanced Type-I SP codebook for 48 ports – Scheme-B | 1. Support of enhanced Type-I SP codebook for Scheme-B with 48 Tx ports by aggregating multiple NZP CSI-RS resources within one slot2. A list of supported combinations, each combination is Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum rank4. Max # of CSI-RS resource in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-1c | yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-B for 48 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {4, 5, 6, 7, 8}Component 4 candidate value {2,3}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-1e | Enhanced Type-I SP codebook for 128 ports – Scheme-B | 1. Support of enhanced Type-I SP codebook for Scheme-B with 128 Tx ports by aggregating multiple NZP CSI-RS resources within one slot2. A list of supported combinations, each combination is Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum rank4. Support 4 CSI-RS resources in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-1c | yes | n/a | Enhanced Type-I SP codebook is not supported for Scheme-B for 128 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {4, 5, 6, 7, 8}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-2 | Enhanced Type-I MP codebook for 64 ports | 1. Support of enhanced Type-I MP codebook for 64 ports within 1 slot2. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum number of panels 4. Max # of CSI-RS resource in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 2-35 | yes | n/a | Enhanced Type-I MP codebook is not supported for 64 ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {2, 4}Component 4 candidate value {2,4}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-2a | Enhanced Type-I MP codebook for 48 ports | 1. Support of enhanced Type-I MP codebook for 48 ports within 1 slot2. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum number of panels 4. Max # of CSI-RS resource in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-2 | yes | n/a | Enhanced Type-I MP codebook is not supported for 48 ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {2, 4}Component 4 candidate value {2,3}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-2b | Enhanced Type-I MP codebook for 128 ports | 1. Support of enhanced Type-I MP codebook for 128 ports within 1 slot2. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. Supported maximum number of panels 4. Support 4 CSI-RS resources in a resource set5. Supported processing capability6. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-2 | yes | n/a | Enhanced Type-I MP codebook is not supported for 128 ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 3 candidate value {2, 4}Component 5 candidate value {Capability 1, Capability 2}Component 6 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU =1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-3 | Extended Rel-16 eType-II codebook for 64 Tx ports | 1. Support of extended Rel-16 eType-II codebook for 64 Tx ports by aggregating multiple NZP CSI-RS resources within 1 slot2. Support of parameter combination 1-63. Support of rank 1-24. Support R=15. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with R=16. supported processing capability7. Max # of CSI-RS resource in a resource set8. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 16-3a | yes | n/a | Extended Rel-16 eType-II codebook is not supported for 64 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 5 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 6 candidate value {Capability 1, Capability 2}Component 7 candidate value {2,4}Component 8 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-3a | Extended Rel-16 eType-II codebook for 48 Tx ports | 1. Support of extended Rel-16 eType-II codebook for 48 Tx ports by aggregating multiple NZP CSI-RS resources within 1 slot2. Support of parameter combination 1-63. Support of rank 1-24. Support R=15. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with R=16. supported processing capability7. Max # of CSI-RS resource in a resource set8. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-3 | yes | n/a | Extended Rel-16 eType-II codebook is not supported for 48 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 5 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 6 candidate value {Capability 1, Capability 2}Component 7 candidate value {2,3}Component 8 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-3b | Extended Rel-16 eType-II codebook for 128 Tx ports | 1. Support of extended Rel-16 eType-II codebook for 128 Tx ports by aggregating multiple NZP CSI-RS resources within 1 slot2. Support of parameter combination 1-63. Support of rank 1-24. Support R=15. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with R=16. supported processing capability7. Support 4 CSI-RS resources in a resource set8. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-3 | yes | n/a | Extended Rel-16 eType-II codebook is not supported for 128 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 5 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 6 candidate value {Capability 1, Capability 2}Component 8 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-3-1 | PMI sub-bands with R=2 for extended Rel-16 eType-II codebook for up to 128 ports | 1. Support of PMI sub-bands with R=2 for extended Rel-16 eType-II codebook for up to 128 ports 2. A list of supported combinations, each combination is {Max # of Tx ports in a report, Max # of ~~sets of aggregated~~ resources, and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with R=2 | 59-2-1-3 | Yes | n/a | PMI sub-bands with R=2 for extended Rel-16 eType-II codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {48, 64, 128}b. {1, …, 64, 128, 256}c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-3-3 | Rank 3,4 for extended Rel-16 eType-II codebook for up to 128 ports | 1. Support of Rank 3,4 for extended Rel-16 eType-II codebook for up to 128 ports 4. Support R=15. A list of supported combinations, each combination is {Max # of Tx ports in a report, Max # of ~~sets of aggregated~~ resources, and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with R=1 | 59-2-1-3 | Yes | n/a | Rank 3,4 for extended Rel-16 eType-II codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 5 candidate valuesa. {48, 64, 128}b. {1, 2, …, 64}c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-4 | Extended Rel-17 FeType-II codebook with 64 Tx ports | 1. Support of extended Rel-17 FeType-II codebook for 64 Tx ports by aggregating multiple NZP CSI-RS resources within 1 slot2. Support of parameter combinations with M=13. Support of rank 1-24. Support R=15. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with M=1 and R=16. Supported processing capability7. Max # of CSI-RS resource in a resource set8. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 23-9-1 | yes | n/a | Extended Rel-17 FeType-II codebook is not supported with 64 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 5 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 6 candidate value {Capability 1, Capability 2}Component 7 candidate value {2,4}Component 8 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources OCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-4a | Extended Rel-17 FeType-II codebook with 48 Tx ports | 1. Support of extended Rel-17 FeType-II codebook for 48 Tx ports by aggregating multiple NZP CSI-RS resources within 1 slot2. Support of parameter combinations with M=13. Support of rank 1-24. Support R=15. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with M=1 and R=16. Supported processing capability7. Max # of CSI-RS resource in a resource set8. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-4 | yes | n/a | Extended Rel-17 FeType-II codebook is not supported with 48 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 5 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 6 candidate value {Capability 1, Capability 2}Component 7 candidate value {2,3}Component 8 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Reuse legacy Z/Z’ valuesOCPU = ceil(P/32)Capability 2: Scale the legacy timeline Z/Z’ by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources OCPU = 1 | Optional with capability signalling |

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| 59. NR\_MIMO\_Ph5 | 59-2-1-5 | Extended Rel-18 eType-II Doppler codebook for 64 Tx ports | 1. Support of extended Rel-18 Type-II Doppler codebook for 64 Tx ports by aggregating multiple NZP CSI-RS resource groups within 1 slot2. Support X=1 CQI based on the first/earliest slot of the CSI reporting window and the first/earliest predicted PMI (TDCQI=’1-1’)3. Support PMI subband R=1 4. Support parameter combinations with L=2,4 5. Support rank = 1,26. Support 64 ports7. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously8. Supported processing capability9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR11. Support for the size of DD-basis, N4=112. Scaling factor for active resource counting Kp13. Max # of CSI-RS resource in a resource group for aperiodic CSI-RS resource set or in a resource set for periodic CSI-RS resource set14. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 40-3-2-1 | yes | n/a | Extended Rel-18 Type-II Doppler codebook is not supported for 64 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 7 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 8 candidate value {Capability 1, Capability 2}Component 9 candidate values: {1, 2, 3}Component 10 candidate values: {1, 2, 3}Component 12 candidate values: {1, 2, 4}Component 13 candidate value {2,4}Component 14 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Legacy timelineOCPU = YxN4xceil(P/32) ), when P/SP-CSI-RS is configured for CMROCPU = Yx KDOPPxceil(P/32)), when A-CSI-RS is configured for CMRCapability 2: Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = YxN4, when P/SP-CSI-RS is configured for CMROCPU = Yx KDOPP, when A-CSI-RS is configured for CMRNote: maximum OCPU is 8Note: KDOPP is the number of CSI-RS resource groups configured for channel measurement, and each CSI-RS resource groups contain K CSI-RS resources for aggregating up to 128 ports | Optional with capability signalling |

**Agreement: 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 | 59-2-1-5a | Extended Rel-18 eType-II Doppler codebook for 48 Tx ports | 1. Support of extended Rel-18 Type-II Doppler codebook for 48 Tx ports by aggregating multiple NZP CSI-RS resource groups within 1 slot2. Support X=1 CQI based on the first/earliest slot of the CSI reporting window and the first/earliest predicted PMI (TDCQI=’1-1’)3. Support PMI subband R=1 4. Support parameter combinations with L=2,4 5. Support rank = 1,26. Support 64 ports7. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously8. Supported processing capability9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR11. Support for the size of DD-basis, N4=112. Scaling factor for active resource counting Kp13. Max # of CSI-RS resource in a resource group for aperiodic CSI-RS resource set or in a resource set for periodic CSI-RS resource set14. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-5 | yes | n/a | Extended Rel-18 Type-II Doppler codebook is not supported for 48 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 7 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 8 candidate value {Capability 1, Capability 2}Component 9 candidate values: {1, 2, 3}Component 10 candidate values: {1, 2, 3}Component 12 candidate values: {1, 2, 4}Component 13 candidate value {2,3}Component 14 candidate valuesa. {1, …, 64}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Legacy timelineOCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMROCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMRCapability 2: Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = Y x N4, when P/SP-CSI-RS is configured for CMROCPU = Y x KDOPP, when A-CSI-RS is configured for CMRNote: maximum OCPU is 8Note: KDOPP is the number of CSI-RS resource groups configured for channel measurement, and each CSI-RS resource groups contain K CSI-RS resources for aggregating up to 128 ports | Optional with capability signalling |

**Agreement: 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 | 59-2-1-5b | Extended Rel-18 eType-II Doppler codebook for 128 Tx ports | 1. Support of extended Rel-18 Type-II Doppler codebook for 128 Tx ports by aggregating multiple NZP CSI-RS resource groups within 1 slot2. Support X=1 CQI based on the first/earliest slot of the CSI reporting window and the first/earliest predicted PMI (TDCQI=’1-1’)3. Support of PMI subband R=1 for extended Rel-18 eType II Doppler codebook4. Support parameter combinations with L=2,45. Support for rank = 1,26. Support 64 ports7. A list of supported combinations, each combination is { Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously8. Supported processing capability9. Value of Y for CPU occupation (OCPU = Y.N4), when P/SP-CSI-RS is configured for CMR10. Value of Y for CPU occupation (OCPU = Y. KDOPP), when A-CSI-RS is configured for CMR11. Support for the size of DD-basis, N4=112. Scaling factor for active resource counting Kp13. Support 4 CSI-RS resources in a resource group for aperiodic CSI-RS resource set or in a resource set for periodic CSI-RS resource set14. A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously | 59-2-1-5 | yes | n/a | Extended Rel-18 Type-II Doppler codebook is not supported for 128 Tx ports, aggregated CSI-RS resources within one slot | Per band and per BC | n/a | n/a | n/a | Component 7 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Component 8 candidate value {Capability 1, Capability 2}Component 9 candidate values: {1, 2, 3}Component 10 candidate values: {1, 2, 3}Component 12 candidate values: {1, 2, 4}Component 14 candidate valuesa. {1, …, 64, 128, 256}b. {64, …, 256, 512, 768, 1024}Note: For component of processing capability Capability 1: Legacy timelineOCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMROCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMRCapability 2: Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resourcesOCPU = Y x N4, when P/SP-CSI-RS is configured for CMROCPU = Y x KDOPP, when A-CSI-RS is configured for CMRNote: maximum OCPU is 8Note: KDOPP is the number of CSI-RS resource groups configured for channel measurement, and each CSI-RS resource groups contain K CSI-RS resources for aggregating up to 128 ports | Optional with capability signalling |

**Agreement: 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 | 59-2-2-1 | Hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | 1. The maximal supported number of CRI report M2. A list of supported combinations, each combination is {Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} across all CCs simultaneously.3. The maximum value of KS | 2-36 | yes | n/a | Hybrid BF (CRI-based) with Rel-15 Type-I SP codebook is not supported | Per band and per BC | n/a | n/a | n/a | Component 1 candidate values: {1,2,3,4}Component 2 candidate values: a. {2,4,8,12,16, 24, 32}b. {1,2,3,4 … 256}c. {64, …, 256, 512, 768, 1024}Component 3 candidate values: {2,3,4,5,6,7,8} | Optional with capability signalling |

**Agreement: 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 | 59-2-2-2 | Hybrid BF (CRI-based) with Rel-16 eType-II codebook | 1. The maximal supported number of CRI report M2. A list of supported combinations, each combination is {Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} across all CCs simultaneously.3. The maximum value of KS | 16-3a | yes | n/a | Hybrid BF (CRI-based) with Rel-16 eType-II codebook is not supported | Per band and per BC | n/a | n/a | n/a | Component 1 candidate values: {1,2}Component 2 candidate values: a. {2,4,8,12,16, 24, 32}b. {1,2,3,4 … 256}c. {64, …, 256, 512, 768, 1024}Component 3 candidate values: {2,3,4~~,5,6,7,8~~} | Optional with capability signalling |

**Agreement: 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 | 59-2-4 | Association up to 128 CSI-RS ports and SRS for non-codebook-based PUSCH | 1. Support association between {48, 64, 128} CSI-RS ports and SRS resource set for non-codebook-based PUSCH2. A list of supported combinations, each combination is {Max # of Tx ports in a set of aggregated resources, Max # of sets of aggregated resource, and total # of Tx ports} simultaneously | 2-15 | Yes | n/a | Association up to 128 CSI-RS ports and SRS for non-codebook-based PUSCH is not supported | Per FS | n/a | n/a | n/a | Component 2 candidate value: Maximum size of the list is 16.The candidate values for the max # of Tx port in in a set of aggregated resources is{48, 64, 128}The candidate value set of the max # of sets of aggregated resource is:{2, …, 64}The candidate value set of total # of ports is:{48, …, 256, 512, 768, 1024}Note: Component 2 is reported per BC | Optional with capability signalling |

**Agreement: 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 | 59-2-1-4b | M=2 and R=1 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64 ports | 1. Support M=2 and R=1 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64 ports 2. Support of parameter combinations with M=23. A list of supported combinations, each combination is {Max # of Tx ports in a report, Max # of sets of aggregated resources, and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with M=2 and R=1 | 59-2-1-4 | Yes | n/a | M=2 and R=1 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 3 candidate valuesa. {48, 64}b. {1, 2, …, 64, 128, 256}c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

**Agreement: 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 | 59-2-1-4c | M=2 and R=2 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64 ports | 1. Support M=2 and R=2 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64ports 2. A list of supported combinations, each combination is {Max # of Tx ports in a report, Max # of sets of aggregated resources, and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with M=2 and R=2 | 59-2-1-4 | Yes | n/a | M=2 and R=2 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {48, 64}b. {1, 2, …, 64, 128, 256}c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

**Agreement: 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 | 59-2-1-5c | N4>1 for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 1. Support for the size of DD-basis, N4>12. A list of supported combinations, each combination is {Max N4, Max # of Tx ports in a report, Max # of sets of aggregated resources or groups of aggregated resource, and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously3. A list of supported combinations, each combination is {Max N4, Max # of Tx ports in a report, Max # of sets of aggregated resources or groups of aggregated resource, and total # of Tx ports} for one CSI report setting4. Value of d=m for the DD unit size when A-CSI-RS is configured for CMR | 59-2-1-5 | Yes | n/a | N4>1 for extended Rel-18 Type-II Dopplercodebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1,2,4,8}b. {48, 64,128}c. {1, 2,3,4 … 64, 128, 256}d. {64, …, 256, 512, 768, 1024}Component 3 Candidate valuesa. {1,2,4,8}b. {48, 64,128}c. {4,8,12}d. {64, …, 256} | Optional with capability signalling |

**Agreement: 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 | 59-2-1-5f | PMI subband R=2 for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 1. Support PMI subband R=2 for Rel-18 Type-II Doppler codebook enhancement for up to 128 ports 2. A list of supported combinations, each combination is {Max N4, Max # of Tx ports in a report, Max # of ~~sets of aggregated~~ resources or groups of aggregated resource, and total # of Tx ports} across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC simultaneously with R=2 | 59-2-1-5 | Yes | n/a | PMI subband R=2 for extended Rel-18 Type-II Dopplercodebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate valuesa. {1,2,4,8}b. {48, 64,128}c. {1, 2,3,4 … 64, 128, 256}d. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

**Agreement: 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 | 59-2-1-9 | NES SD Type1 for Rel-19 Type-I single-panel codebook | 1. Support NES SD Type1 for Rel-19 Type-I single-panel codebook2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook3 Supported number of ports for CSI report subconfig | 59-2-1-1, 1a, 1b, 1c, 1d, or 1e and 42-1,1a, 1b or 1c | Yes | n/a | NES SD Type1 for Rel-19 Type-I single-panel codebook is not supported | ~~[~~Per-band and per-BC~~]~~ | n/a | n/a | n/a | Component 2 candidate values:* Capability 1: Reuse legacy Z/Z’ values (i.e., Z2 and Z’2)
* Capability 2 timeline: Scale the legacy timeline Z/Z’ (i.e., Z2 and Z’2) by where M is the number of sub-configurations that refer to the any of the K aggregated CSI-RS resources

Component 3 candidate values: One or more values from {2, 4, 8, 12, 16, 24, 32, 48, 64, 128} | Optional with capability signaling |

**Conclusion: The following is RAN1’s understanding for Case 1 in Question 1 in the RAN2 LS on per band and per BC capability (R1-2506724):**

* **When UE indicates both per band and per BC capability, regardless of whether CA is configured or not, if the capability/component is not counted across CCs, then the minimum capability between per BC capability and per band capability should be applied for a band in case of band combination (CA)**
	+ **RAN1 will continue to discuss the case(s) when the capability is counted across CCs**
* **RAN1 will review by RAN1 #123 for which FGs special rules/handling may need to be defined in Rel. 19, e.g., in some cases a clear “ranking” between capabilities may need to be clarified in the Notes**

**Conclusion: The following is RAN1’s understanding for Case 2 in Question 1 in the RAN2 LS on per band and per BC capability (R1-2506724):**

* **RAN2’s understanding is generally correct**
* **RAN1 will review by RAN1 #123 for which FGs special rules/handling may need to be defined in Rel. 19**

**Conclusion: The following is RAN1’s understanding for Case 3 in Question 1 in the RAN2 LS on per band and per BC capability (R1-2506724):**

* **RAN2’s understanding is generally correct**
* **RAN1 will review by RAN1 #123 for which FGs special rules/handling may need to be defined in Rel. 19**

**Conclusion: The following is RAN1’s understanding for Question 2 in the RAN2 LS on per band and per BC capability (R1-2506724):**

* **For per band and per BC capabilities, it is expected that UE indicates the same granularity as the pre-requisite**

**Agreement: 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 | 59-3-3 | 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 UE2. Report the entry number of the first-listed band with UL in the band combination that affects this DL3. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL |  | yes | n/a | 3TX 3T6R antenna switching is not supported | Per FS | n/a | n/a | n/a | Component 2 candidate value: {1,2, … 32}Component 3 candidate value: {1,2, … 32}Note: This UE feature can be signalled together with srs-AntennaSwitching8T8R-r18, srs-AntennaSwitchingBeyond4RX-r17, supportedSRS-TxPortSwitch-v1610, ~~or~~ supportedSRS-TxPortSwitch or 59-3-3a to indicate SRS antenna switching downgrading capability. | Optional with capability signalling |

**Agreement: 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 | 59-4-4d | PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on ~~CRFA~~ CFRA for inter-cell without CORESETPoolIndex | Support of PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on ~~CRFA~~ CFRA for inter-cell  | 59-4-4b  | yes | n/a | PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on ~~CRFA~~ CFRA for inter-cell is not supported without CORESETPoolIndex | Per FS | No | No | n/a |  | Optional with capability signalling |

**Agreement: 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 | 59-4-9a | DCI format 1\_1 to indicate one of two separate SRS closed loop indexes under separate DL/UL TCI state mode | Support of DCI format 1\_1 to indicate one ~~or~~ of two separate SRS closed loop index(es) under separate DL/UL TCI state mode | 59-4-8 | yes | n/a | DCI 1\_1 indicating one of two separate SRS closed loop indexes under separate DL/UL TCI state mode is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-9b | DCI format 1\_1 to indicate one of two separate SRS closed loop indexes under joint TCI state mode | Support of DCI format 1\_1 to indicate one ~~or~~ of two separate SRS closed loop index(es) under joint TCI state mode | 59-4-8 | yes | n/a | DCI 1\_1 indicating one of two separate SRS closed loop indexes under joint TCI state mode is not supported | Per band | n/a | FR1 only | n/a |  | Optional with capability signalling |

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

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| 59. NR\_MIMO\_Ph5 | 59-4-4c | RX timing difference larger than CP length for two TAs without restriction of multi-DCI based multi-TRP operation | Support of the RX timing difference between the two DL reference timings is larger than CP length for two TAs without restriction of multi-DCI based multi-TRP | 59-4-4a or 59-4-4b | yes | n/a | RX timing difference between the two DL reference timings is no larger than CP length for two TAs without restriction of multi-DCI based multi-TRP | Per FS | n/a | n/a | n/a |  | Optional with capability signalling |

**Revised Conclusion: The following is RAN1’s understanding for Case 1 in Question 1 in the RAN2 LS on per band and per BC capability (R1-2506724):**

* **When UE indicates both per band and per BC capability, ~~regardless of whether CA is configured or not,~~ if the capability/component is not counted across CCs, then the minimum capability between per BC capability and per band capability should be applied for a band in case of band combination (CA)**
	+ **RAN1 will continue to discuss the case~~(~~s~~)~~**
		- **when the capability/component is counted across CCs regardless of whether CA is configured or not**
		- **when the capability/component is not counted across CCs and CA is not configured**
	+ **RAN1 will review by RAN1 #123 for which FGs special rules/handling may need to be defined in Rel. 19, e.g., in some cases a clear “ranking” between capabilities may need to be clarified in the Notes**

R1-2506882 UE features for NR MIMO Phase 5 vivo

R1-2506924 UE features for NR MIMO Phase 5 Huawei, HiSilicon

R1-2507038 Discussion on UE features for NR MIMO Phase 5 ZTE Corporation, Sanechips

R1-2507073 NR MIMO Phase 5 UE features Nokia

R1-2507127 Maintenance on UE features for NR MIMO Phase 5 CATT

R1-2507160 UE features for NR MIMO Phase 5 OPPO

R1-2507237 UE features for NR MIMO Phase 5 Samsung

R1-2507460 Views on UE features for NR MIMO Phase 5 Ofinno

R1-2507705 UE features for NR MIMO phase 5 Qualcomm Incorporated

R1-2507739 Summary of UE features for NR MIMO Phase 5 Moderator (AT&T)

R1-2507796 Discussion on MIMO UE features NTT DOCOMO, INC.

R1-2507863 Discussion on UE features for NR MIMO Phase 5 Ericsson