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

**Bengaluru, India, Aug 25th – 29th, 2025**

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

**Title: Session Notes of AI** **9.1**

**Agenda Item: 9.1**

**Document for: Endorsement**

### 9.1 UE features for AI/ML for NR Air Interface

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

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| 58. NR\_AIML\_air | 58-0-1 | CSI report framework for UE-side inference | 1. Number of APU pools N~~1~~2. Maximum number of APUs in each APU pool ~~for all types~~ of UE-sided inference for CSI report(s) for simultaneously in a CC ~~2~~3. Maximum number of APUs in each APU pool ~~for all types~~ of UE-sided inference for CSI report(s) simultaneously across all CCs | FFS | yes | n/a | Maximum number of APUs for UE-sided inference is unknown to the network | ~~FFS~~ Per UE | ~~FFS~~ N/A | ~~FFS~~ N/A | ~~FFS~~ N/A | Component 1 candidate values: {1,2}Component ~~1~~2 candidate values: ~~FFS~~{1…8}Component ~~2~~3 candidate values: ~~FFS~~{1…32}Note: Component 2 and 3 candidate values are signalled separately for each pool[A UE that does not support this FG reuses the CPU] | Optional with capability signalling |

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| 58. NR\_AIML\_air | 58-1-1 | Increased number of reported RSs for beam management | 1. Support of reporting format for L1-RSRP measurements not including CRI/SSBRI other than one for the largest measured L1-RSRP in a reporting instance, if the number of reported L1-RSRPs is equal to the size of the measurement resource set.2. Support of reporting format for L1-RSRPs and corresponding beam information of Top M beam(s) with largest M measured value(s) of L1-RSRP(s) of a measurement resource set, where M is configured by gNB, if the number of reported L1-RSRPs is smaller than the size of the measurement resource set3. Maximum number of M reported RSs, M>4 | FFS | yes | n/a | Increased number of reported beams for beam management is not supported | ~~FFS~~ Per UE | ~~FFS~~ N/A | ~~FFS~~ N/A | ~~FFS~~ N/A | Component 3 candidate values: {6,8} | Optional with capability signalling |

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| 58. NR\_AIML\_air | 58-1-2 | UE-side beam prediction for BM Case1 [for inference] | 1. Support of beam prediction with reporting of predicted beam index for BM-Case1 [for inference] with UE-side model3. Maximum number of inference report(s) configured for BM-Case1 per BWP3a. Maximum number of inference report(s) configured for BM-Case1 across all CCs[4. Maximum number of inference report(s) activated for BM-Case1 per BWP][4a. Maximum number of inference report(s) activated for BM-Case1 across all CCs][5. Maximum number of inference report(s) triggered for BM-Case1 per BWP][5a. Maximum number of inference report(s) triggered for BM-Case1 across all CCs]6. Support of SSB as RS type for Set B6a. Support of CSI-RS as RS type for Set B6b. Support of SSB as RS type for Set A6c. Support of CSI-RS as RS type for Set A[7. Supported combinations of the number of resources for Set B and the number of resources for Set A][7a: Supported maximum number of resources for Set B][7b: Supported maximum number of resources for Set A]~~[~~8. Supported CSI-RS resource types: Periodic CSI-RS, Semi-persistent CSI-RS, Aperiodic CSI-RS~~]~~~~[~~9. Supported inference report types: Periodic CSI report, Aperiodic CSI report, semi-persistent CSI report~~]~~~~[10. Supported options for performance monitoring for beam case 1 with UE side model]~~~~[~~11. Supported BM-Case 1 sub-usecase(s): {setB-subset-of-setA, setB-different-from-setA, both}12. Supported maximum number of predicted beams in each reporting instanceFFS: whether/how to merge this FG with other FG(s) for performance monitoring and/or data collection13. Supported number of occupied CPU 14. Supported number of occupied APU 15. Supported value of d for the relaxation of Z3 timeline 16. Supported value of d’ for the relaxation of Z’3 timeline 17. Index of the occupied APU pool | FFS | yes | n/a | UE-side~~d~~ beam prediction for BM Case 1 [for inference] is not supported | FFS | FFS | FFS | FFS | ~~FFS: CPU/AIMLPU related information~~ | Optional with capability signalling |

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| 58. NR\_AIML\_air | 58-1-3 | UE-side beam prediction for BM Case1 with predicted RSRP [for inference] | 1. Support of beam prediction, reporting of predicted beam index and predicted RSRP, for BM-Case1 [for inference]2. Supported maximum number of predicted beams with RSRP in each reporting instance | 58-1-2 | yes | n/a | UE-side beam prediction for BM Case 1 with predicted RSRP [for inference] is not supported | FFS | FFS | FFS | FFS | Component 2 candidate values: {1, 2, 3, 4}~~FFS: CPU/AIMLPU related information~~ | Optional with capability signalling |

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| 58. NR\_AIML\_air | 58-1-4 | UE-side beam prediction for BM Case2 [for inference] | 1. Support of beam prediction with reporting of predicted beam index for BM-Case2 [for inference] with UE-side model3. Maximum number of inference report(s) configured for BM-Case2 per BWP3a. Maximum number of inference report(s) configured for BM-Case2 across all CCs[4. Maximum number of inference report(s) activated for BM-Case2 per BWP][4a. Maximum number of inference report(s) activated for BM-Case2 across all CCs][5. Maximum number of inference report(s) triggered for BM-Case2 per BWP][5a. Maximum number of inference report(s) triggered for BM-Case2 across all CCs]6. Support of SSB as RS type for Set B6a. Support of CSI-RS as RS type for Set B6b. Support of SSB as RS type for Set A6c. Support of CSI-RS as RS type for Set A[7. Supported combinations of the number of resources for Set B and the number of resources for Set A][7a: Supported maximum number of resources for Set B][7b: Supported maximum number of resources for Set A]~~[~~8. Supported CSI-RS resource types: Periodic CSI-RS, Semi-persistent CSI-RS~~]~~~~[~~9. Supported inference report types: Periodic CSI report, Aperiodic CSI report, semi-persistent CSI report~~]~~~~[10. Supported options for performance monitoring for beam case 2 with UE side model]~~11. Supported maximum number of predicted beams in each predicted time instance12. Supported maximum number of predicted time instances~~[~~13. Supported maximum total number of reported predicted beams for predicted time instances in one report~~]~~14. Supported combinations of supported value(s) of valid time duration for each predicted time instance and number of predicted beams for each value of valid time duration~~[20. Supported BM-Case 2 sub usecase(s): e.g., setB-equals-to-setA, setB-subset-of-setA, setB-different-from-setA, or merged version(s)]~~21. supported number of occupied CPU 22. supported number of occupied APU 23. supported value of d for the relaxation of Z3 timeline 24. supported value of d’ for the relaxation of Z’3 timeline 17. Index of the occupied APU pool | FFS | yes | n/a | UE-side beam prediction for BM-Case2 [for inference] is not supported | FFS | FFS | FFS | FFS | ~~FFS: CPU/AIMLPU related information~~FFS: candidate values for components | Optional with capability signalling |

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| 58. NR\_AIML\_air | 58-1-5 | UE-side beam prediction for BM-Case2 with predicted RSRP [for inference] | 1. Support of beam prediction, reporting of predicted beams and predicted RSRP, for BM-Case2 (spatial and time domain beam prediction) [for inference] | 58-1-4 | yes | n/a | UE-side beam prediction for BM-Case2 [for inference] is not supported | FFS | FFS | FFS | FFS | ~~FFS: CPU/AIMLPU related information~~ | Optional with capability signalling |

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| 58. NR\_AIML\_air | 58-1-7 | Data collection for UE-side beam prediction [for BM case 1] | 1. Support of data collection for UE-side beam prediction [for BM case 1]2. Support of SS/PBCH block and 1-port CSI-RS based RSRP measurements for measurement RS resource sets (Set B and Set A) for data collection ~~[~~3. Supported sub-use cases~~: {‘Set B equal to Set A’, ‘Set B subset of Set A’,’Set B not a subset of Set A’}]~~~~[~~6: Supported maximum number of resources for Set B~~]~~~~[~~7: Supported maximum number of resources for Set A~~]~~8. Support of SSB as RS type for Set B9. Support of CSI-RS as RS type for Set B10. Support of SSB as RS type for Set A11. Support of CSI-RS as RS type for Set A | FFS | yes | n/a | Data collection for UE-side beam prediction is not supported [for BM case 1] | ~~FFS~~ Per UE | ~~FFS~~ N/A | ~~FFS~~ N/A | ~~FFS~~ N/A | Component 3 candidate values: {‘Set B equal to Set A’, ‘Set B subset of Set A’,’Set B not a subset of Set A’}Component 6 candidate values: {4, 8, 16, 32, 64}Component 7 candidate values: {8, 16, 32, 64}Note: it is up to RAN2 whether this FG is merged into data collection FG defined by RAN2 | Optional with capability signalling |

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| 58. NR\_AIML\_Air | 58-3-1 | CSI prediction for UE-sided inference when N4=1 | 1. Support of CSI prediction for UE-sided inference when N4=12. Support for reporting predicted PMI with N4=13. 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 simultaneously4. Support of Rel-16 eType-II regular codebook refinement for predicted PMI with PMI subband R=1 5. Support parameter combinations with L=2,4 6. Support for rank = 1,27. Support for the size of DD-basis, N4=18. Support X=1 CQI based on the first/earliest slot of the CSI reporting window and the first/earliest predicted PMI (TDCQI=’1-1’)~~[~~9. Value for CPU occupation, when P/SP-CSI-RS is configured for CMR~~]~~~~[~~10. Value for CPU occupation, when A-CSI-RS is configured for CMR~~]~~11. Scaling factor for active resource counting Kp**Alt. 1**12. The number of additional symbols, t\_i, between the last symbol of CSI-RS and the first symbol of the transmission channel containing predicted CSI report, where i is the index of SCS, i=1,2,3,4 corresponding to 15,30,60,120 kHz SCS13. The number of additional symbols, t\_i’, between the last symbol of CSI-RS and the first symbol of the transmission channel containing predicted CSI report, wherei is the index of SCS, i=1,2,3,4 corresponding to 15,30,60,120 kHz SCS**Alt. 2**12. supported value of t for the relaxation of Z and Z’ timeline14. Index about which APU resource pool is CPU\_2 | ~~2-35~~ 58-0-1 | yes | n/a | CSI prediction for N4=1 for inference is not supported | ~~[~~Per band and Per BC~~]~~ | n/a | n/a | n/a | Component 3 candidate values:a. {4,8,12,16,24,32}b. {2,3,4 … 64}c. {4, …, 256}Compontent 9 candidate values when P/SP-CSI-RS is configured for CMR:O\_CPU=M, M∈{0,1,2,3,4}O\_APU=N, N∈{0,1,2,3,4}Compontent 10 candidate values: - when A-CSI-RS is configured for CMR and K<12, where where K is the number of A-CSI-RS resourcesO\_CPU=M=Y\_1 K, Y\_1∈{0,1,2,3}O\_APU=N=X\_1 K, X\_1∈{0,1,2,3}- when K=12O\_CPU=M, M={0…8}O\_APU=N, N={0…8} | Optional with capability signalling |

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| 58. NR\_AIML\_Air | 58-3-1-7 | Active CSI-RS resources and ports for mixed R16 based doppler codebook for CSI prediction via UE side model with other codebooks in any slot  | 1. List of codebook combinations of two types2. List of {max number of ports per resource, max number of resources, max number of total ports} for each codebook combination  | 23-9-1, 16-3a, 2-36, 2-40, 2-41, 23-9-2, 23-9-4, 40-3-2-1, 40-3-2-1a, 40-3-2-2, X-1-1, X-1-1a, X-1-2 | Yes | n/a | Active CSI-RS resources and ports for mixed R16 based doppler codebook for CSI prediction via UE side model with other codebooks in any slot is not supported  | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: ~~FFS~~{Type I SP, CSI prediction for UE-sided inference when N4=1 and R=1}{Type I SP, CSI prediction for UE-sided inference when N4>1 and R=1}{eType II R=1, CSI prediction for UE-sided inference when N4=1 and R=1}{eType II R=1, CSI prediction for UE-sided inference when N4>1 and R=1}Component 2 candidate values: ~~FFS~~- Maximum 16 triplets - Max # of Tx ports in one resource: {4,8,12,16,24,32} - Max # resources: {1 to 64} - Max # total ports: {4 to 256}Note: if a UE reports one or more codebook combinations in 58-3-1-7, then usage of active CSI-RS resources and ports for multiple codebooks in any slot is allowed only within those combinationsNote: For coexisting of mixed codebooks in any slot, gNB need to honor 16-8, 23-9-5, 58-3-1-7 and per-codebook capability 2-36/40/41, 16-3a, and 23-9-1/23-9-2/23-9-4. ~~[Note: Up to 4 combinations for component 1]~~ | Optional with capability signaling |

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| 58. NR\_AIML\_Air | 58-3-2 | CSI prediction for UE-sided inference when N4>1 | 1. Support of CSI prediction for UE-sided inference when N4>12. Support for reporting predicted PMI with N4>13. A list of supported combinations, each combination is {Max N4, 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 simultaneously4. Value of d=m for the DD unit size when A-CSI-RS is configured for CMR5. Support for the size of DD-basis, N4>17. A list of supported combinations, each combination is {Max N4, Max # of Tx ports in one resource, Max # of resources and total # of Tx ports} for one CSI report setting~~[~~8. Supported values of the maximum number of observation number~~]~~ | 58-3-1 | yes | n/a | CSI prediction for N4>1 for inference is not supported | ~~[~~Per band and Per BC~~]~~ | ~~FFS~~ N/A | ~~FFS~~ N/A | ~~FFS~~ N/A | ~~FFS: CPU/AIMLPU related information~~Component 3 candidate values: ~~FFS~~a. {1,2,4,8}b. {4,8,12,16,24,32}c. {2,3,4 … 64}d. {4, …, 256}Component 7 candidate values:a. {1,2,4,8}b. {4,8,12,16,24,32}c. {4,8,12}d.{4, …, 256} | Optional with capability signalling |

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| 58. NR\_AIML\_Air | 58-3-4 | UE side data collection for CSI prediction  | 1. Support of data collection for CSI prediction  | FFS | yes | n/a | UE side data collection for CSI prediction is not supported | ~~FFS~~ Per band and Per BC | ~~FFS~~ N/A | ~~FFS~~ N/A | ~~FFS~~ N/A |  | Optional with capability signalling |

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

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| 58. NR\_AIML\_Air | 58-3-3 | Aperiodic CSI report timing relaxation | Support of aperiodic CSI report time relaxation is equal to t + Z/Z’ | 58-3-1, 58-3-2 | Yes | n/a | Aperiodic CSI report timing relaxation is not supported | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

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

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| 58. NR\_AIML\_Air | 58-3-5 | Performance monitoring for CSI prediction model | 1. Performance metric SGCS2. One wideband frequency gruanularity SGCS per layer3. One monitoring resource set 4. One configured time instance for N4>15. 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 simultaneously | 58-3-1 | Yes | n/a | Performance monitoring for CSI prediction model is not supported | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

R1-2505179 UE Features for Rel-19 AI/ML for NR Air Interface Ericsson Telecom S.A. de C.V.

R1-2505189 UE features for AI/ML for NR Air Interface Nokia

R1-2505334 Discussion on UE features for AI/ML for NR Air Interface CATT, CICTCI

R1-2505343 UE features for AI/ML for NR air interface Huawei, HiSilicon

R1-2505394 UE features for AI/ML for NR Air Interface vivo

R1-2505443 Discussion on UE features for AI/ML for NR Air Interface Xiaomi

R1-2505489 Discussion on UE features for AI/ML for NR Air Interface ZTE Corporation, Sanechips

R1-2505560 Remaining issues on UE features for AI/ML for NR air interface Samsung

R1-2505667 Views on Rel-19 UE features for AI/ML for NR Air Interface Ofinno

R1-2505734 UE features for AIML for NR air interface OPPO

R1-2505818 Discussion on UE features for AI/ML for NR Air Interface LG Electronics

R1-2505893 Views on UE features for AI/ML for NR Air Interface Apple

R1-2505899 Views on UE features for Rel-19 IoT-NTN TDD mode Apple

R1-2506086 Discussion on UE features for AI/ML for NR air Interface CMCC

R1-2506195 UE features for AI/ML for NR air interface Qualcomm Incorporated

R1-2506226 Summary of UE features for AI/ML for NR Air Interface Moderator (AT&T)

R1-2506284 Discussion on UE features for AI/ML for NR Air Interface NTT DOCOMO, INC.