**3GPP TSG RAN WG1 #122bis R1-2507739**

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

**Agenda Item: 9.2**

**Source: Moderator (AT&T)**

**Title: Summary of UE features for NR MIMO Phase 5**

**Document for:** **Discussion/Decision**

# Introduction

This document presents the summary of email discussion [122bis-R19-UE\_features] during RAN1 #122bis. According to the Chair’s Notes:

|  |
| --- |
| [122bis-R19-UE\_features] Email discussion on Rel-19 UE features – Ralf (AT&T), Naoya (DOCOMO)   * To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc |

The following was discussed during RAN1 #122bis within the scope of [122bis-R19-UE\_features]. All proposals are based on the latest RAN1 UE features list for Rel. 19 in [1].

# Summary of Contributions Submitted to RAN1 #122bis

The following is the moderator’s summary of contributions submitted to RAN1 #122bis in this agenda item.

## UE-initiated/event-driven beam management

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-1 | UE-initiated/event-driven beam management for Event-2 based measurement and report for Mode A | 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 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  6. Support the first PUCCH and second PUSCH from the same PUCCH group |  | yes | n/a | UEI/ED beam report is not supported for Event-2 and Mode A | Per band | n/a | n/a | n/a | Component 4 candidate values: {1, 2, …, 64}  Note For Component 4 and Component 5, an SSB can be associated with the serving cell PCI or a PCI other than the serving cell PCI  Note: Regarding Event-2, QCL RS(s) in indicated TCI state(s) and resources configured for component 4 are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | * For FG 59-1-1 of Mode-A based UE-initiated beam reporting,   Given that UE-initiated beam reporting basically includes two functionalities of beam measurement and beam reporting, the corresponding prerequisites FG 2-22 (which is for aperiodic beam report on PUSCH) and FG 2-24 (which is for SSB/CSI-RS based beam measurement) are needed.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-1 | UE-initiated/event-driven beam management for Event-2 based measurement and report for Mode A | 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 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  6. Support the first PUCCH and second PUSCH from the same PUCCH group | 2-22, 2-24 | yes | n/a | UEI/ED beam report is not supported for Event-2 and Mode A | Per band | n/a | n/a | n/a | Component 4 candidate values: {1, 2, …, 64}  Note For Component 4 and Component 5, an SSB can be associated with the serving cell PCI or a PCI other than the serving cell PCI  Note: Regarding Event-2, QCL RS(s) in indicated TCI state(s) and resources configured for component 4 are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling | |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-1 | UE-initiated/event-driven beam management for Event-2 based measurement and report for Mode A | 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 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  6. Support the first PUCCH and second PUSCH from the same PUCCH group | 23-1-1 | yes | n/a | UEI/ED beam report is not supported for Event-2 and Mode A | Per band | n/a | n/a | n/a | Component 4 candidate values: {1, 2, …, 64}  Note For Component 4 and Component 5, an SSB can be associated with the serving cell PCI or a PCI other than the serving cell PCI  Note: Regarding Event-2, QCL RS(s) in indicated TCI state(s) and resources configured for component 4 are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling | |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-6 | First PUCCH and second PUSCH from different PUCCH groups | Support first PUCCH and second PUSCH from different PUCCH groups | FG 59-1-1 | yes | n/a | First PUCCH and second PUSCH from different PUCCH groups is not supported | Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-6 | First PUCCH and second PUSCH from different PUCCH groups | Support first PUCCH and second PUSCH from different PUCCH groups | ~~FG~~ 59-1-1 | yes | n/a | First PUCCH and second PUSCH from different PUCCH groups is not supported | Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-6 | First PUCCH and second PUSCH from different PUCCH groups | Support first PUCCH and second PUSCH from different PUCCH groups | 59-1-1 | yes | n/a | First PUCCH and second PUSCH from different PUCCH groups is not supported | Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

## CSI enhancements for up to 128 ports

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 resources  within one slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 resources  within one slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum rank  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 1024}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum rank  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum number of panels  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Component 3 candidate value {2, 4}  Component 4 candidate value {2,4}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum number of panels  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum number of panels  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Component 3 candidate value {2, 4}  Component 4 candidate value {2,3}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum number of panels  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum number of panels  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Component 3 candidate value {2, 4}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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  3. Supported maximum number of panels  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {1, …, 64, 256}  b. {64, …, 256, 1024}  Component 6 candidate value {Capability 1, Capability 2}  Component 7 candidate value {2,4}  Component 8 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {1, …, 64, 256}  b. {64, …, 256, 1024}  Component 6 candidate value {Capability 1, Capability 2}  Component 7 candidate value {2,3}  Component 8 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Support 4 CSI-RS resources in a resource set  8. 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 values  a. {1, …, 64, 256}  b. {64, …, 256, 1024}  Component 6 candidate value {Capability 1, Capability 2}  Component 8 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Support 4 CSI-RS resources in a resource set  8. 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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Component 6 candidate value {Capability 1, Capability 2}  Component 8 candidate values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 values  a. {48, 64, 128}  b. {1, …, 64}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 values  a. {48, 64, 128}  b. {1, …, 64, 128, 256}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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=1  5. 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 values  a. {48, 64, 128}  b. {1, 2, …, 64}  c. {64, …, 256, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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=1  5. 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 values  a. {48, 64, 128}  b. {1, 2, …, 64}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combinations with M=1  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. Supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Component 6 candidate value {Capability 1, Capability 2}  Component 7 candidate value {2,4}  Component 8 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. Support of parameter combinations with M=1  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. Supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combinations with M=1  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. Supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {1, …, 64}  b. {64, …, 256}  Component 6 candidate value {Capability 1, Capability 2}  Component 7 candidate value {2,3}  Component 8 candidate values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. Support of parameter combinations with M=1  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. Supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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 = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {1, …, 64}  b. {64, …, 256}  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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = YxN4xceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Yx KDOPPxceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = YxN4, when P/SP-CSI-RS is configured for CMR  OCPU = Yx KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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 = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = YxN4xceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Yx KDOPPxceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = YxN4, when P/SP-CSI-RS is configured for CMR  OCPU = Yx KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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 = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {1, …, 64}  b. {64, …, 256}  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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = Y x N4, when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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 = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {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 values  a. {1, …, 64}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = Y x N4, when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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 codebook  4. Support parameter combinations with L=2,4  5. Support for rank = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation (OCPU = Y.N4), when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation (OCPU = Y. KDOPP), when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {1, …, 64}  b. {64, …, 256, 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 values  a. {1, …, 64}  b. {64, …, 256, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = Y x N4, when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 slot  2. 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 codebook  4. Support parameter combinations with L=2,4  5. Support for rank = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation (OCPU = Y.N4), when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation (OCPU = Y. KDOPP), when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = Y x N4, when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | One or more of {59-2-1-1, 59-2-1-1c} | yes | n/a | Group-specific 3-bit scaling factors is not supported | Per band and per BC | n/a | n/a | n/a | Candidate values: {’rank-1’, ‘rank-1 and rank-2’}  Note: 3-bit scaling applies only to the Type-I SP codebook | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] | The candidate values are ‘rank-1’ and ‘rank-1 and rank-2’.    Which one among the candidate values is a lower capability needs to be determined. Assuming the following capability indication   * Band 1: ‘rank-1’ * Band 2: ‘rank-1 and rank-2’ * CA-n1\_n2: ‘rank-1’   If ‘rank-1’ is treated as a lower capability than ‘rank-1 and rank-2’, then the actual supported capabilities for the two bands can be determined as follows:   * The actual supported capability for Band 1 in CA-n1\_n2 is ‘rank-1’ since ‘rank-1’ is indicated for both Band 1 and CA-n1\_n2. * The actual supported capability for Band 2 in CA-n1\_n2 is ‘rank-1’ since ‘rank-1’ indicated for CA-n1\_n2 is a lower capability than ‘rank-1 and rank-2’ indicated for Band 2.  1. For FG 59-2-1-7, for the purpose of determining actual supported capability when capabilities are signaled per band and per BC, ‘rank-1’ is a lower capability than ‘rank-1 and rank-2’. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook | 59-2-1-1, 1a, 1b, 1c, 1d, or 1e | 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 | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook | 59-2-1-1, 1a, 1b, 1c, 1d, or 1e | 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 | Optional with capability signaling | |
| Huawei/HiSilicon [3] | For FG 59-2-1-9, since the corresponding UE features of Rel-19 Type-I single-panel codebook and NES SD Type1 codebook of FG 42-1/1a/1b/1c are based on the granularity of “per band and per BC”, so we suggest the following updates.  ***Proposal 2.1: Update the UE feature list as below:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook | 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 | Optional with capability signaling | |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook | 59-2-1-1, 1a, 1b, 1c, 1d, or 1e | 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 | Optional with capability signaling | |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook | 59-2-1-1, 1a, 1b, 1c, 1d, or 1e | 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 | Optional with capability signaling | |
| CATT [6] |  |
| OPPO [7] | The prerequisite of NES SD Type 1 for Rel-19 Type-I single-panel codebook should include not only Rel-19 Type-I single-panel codebook, but also Rel-18 NES SD Type 1 (FG 42-1/1a/1b/1c), which includes the basic UE capability for spatial domain adaptation (e.g. CSI report sub-configurations). Without FG 42-1/1a/1b/1c, UE is not able to support 59-2-1-9.  ***Proposal: The following update is supported for UE feature of Rel-19 CSI:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook | 59-2-1-1, 1a, 1b, 1c, 1d, or 1e, 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 | Optional with capability signaling | |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | **Proposal 2-1: Support the following changes of RAN1#121-agreed UE feature groups for Up-to-128-port Type-I/II CSI.**   1. **Note that the changes to FG 59-2-1-9 is according to the following agreement made in RAN#121 Malta.**   **Agreement (RAN1#121, 2025-05)**  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, when configured with port subset indication (from the Rel-18 SD NES Type-1), the actual number of ports (the number of 1s in the *port-subsetIndicator* bitmap) can correspond to a supported value of PCSI-RS for the Rel-19 Type-I SP codebook (i.e. either 48, 64, or 128), or to a supported value of PCSI-RS for the Rel-15 Type-I SP codebook (i.e., either 2, 4, 8, 12, 16, 24, 32), respectively   1. The supported number of ports for port subset of the full PCSI-RS ports, is according to UE capability  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook  3 Supported number of ports for CSI report subconfig | 59-2-1-1, 1a, 1b, 1c, 1d, or 1e | 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:   1. Capability 1: Reuse legacy Z/Z’ values (i.e., Z2 and Z’2) 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 | |
| NTT DOCOMO, INC. [11] | For FG 59-2-1-9, since its prerequisite FGs are per-band and per-BC, it should be also per-band and per-BC.  **Proposal 1: Support ‘per band and per-BC’ for FG 59-2-1-9.** |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 M  2. 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, 1024}  Component 3 candidate values: {2,3,4,5,6,7,8} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 M  2. 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 M  2. 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, 1024}  Component 3 candidate values: {2,3,4,5,6,7,8} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] | For CRI(s)-based CSI reporting, the following UE capability related agreements have been agreed:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, the supported combinations of KS value and the maximum number of ports per NZP CSI-RS resource are as follows:   * FFS: UE capability on KS and the number of ports per resource  |  |  | | --- | --- | | KS | **Maximum # ports per resource** | | 2, 3, 4 | 32 | | 5, 6, 7, 8 | 16 |   **Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports,   * For Rel-15 Type-I Single Panel codebook, M is NW-configured via higher-layer (RRC) signaling with candidate value(s) of {1, …, min(4,KS)}   + The maximum value of M is subject to UE capability * For Rel-16 eType-II, M=1 is supported   + The maximum value of KS is {1,2,3,4} and subject to UE capability     - The support for Rel-16 eType-II is a separate UE capability at least from the support for Rel-19 Type-I and Type-II codebook refinements   + FFS (RAN1#116bis): The support for M=2, and if so, the value of M={1, 2} is NW-configured via higher-layer (RRC) signaling, and if additional restriction(s) are needed   **Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports,   * When M>1, the M PMIs are independently calculated and indicated * with the Rel-16 eType-II codebook and KS={1,2,3,4}, support M=2 with a maximum of 16 ports per resource, R=1 only, and a maximum UCI payload of 1706 bits.   + The value of M={1, 2} is NW-configured via higher-layer (RRC) signalling   + The maximum value of M is subject to UE capability * on the configured KS>1 NZP CSI-RS resources, reuse the legacy IMR rule for the Rel-15 CRI-based reporting for NZP CSI-RS resource for interference measurement, i.e. only 1 NZP CSI-RS resource for interference measurement can be configured   **Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, for A-CSI only, the NW can configure *MR* (<*M*) of *KS* CSI-RS resources to be selected as part of reporting the *M* “quadruplets”:   * (*M–MR*) CRIs, each with bits are reported, along with the *M* sets of CQI/PMI/RI/(if applicable) LI * The value of *MR* is NW-configured via higher-layer (RRC) signaling * The *MR* selected resources are NW-configured via higher-layer (RRC) signaling * FFS: value of *MR* * This is an optional UE capability |   According to the above agreement, for Hybrid BF (CRI-based) with Rel-16 eType-II codebook, the maximum value of KS is subject to UE capability and the candidate values can be {2,3,4}. Hence, the candidate value {5,6,7,8} of KS in FG 59-2-2-2 should be removed.  ***Proposal 2.2: For FG 59-2-2-2, remove the candidate value {5,6,7,8} of KS.***  ***Proposal 2.3: Update the UE feature table as below***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 M  2. 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, 1024}  Component 3 candidate values: {2,3,4,~~5,6,7,8~~} | Optional with capability signalling | |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 M  2. 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 | |
| Nokia [5] |  |
| CATT [6] | In RAN1 #116bis meeting, the following agreement on the maximum value of KS for the hybrid BF(CRI-based) with Rel-16 eType-II codebook was achieved. According to the agreement, for FG59-2-2-2, the candidate values for the maximum value of KS should be {2,3,4}.   |  | | --- | | **Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports,   * For Rel-15 Type-I Single Panel codebook, M is NW-configured via higher-layer (RRC) signaling with candidate value(s) of {1, …, min(4,KS)}   + The maximum value of M is subject to UE capability * For Rel-16 eType-II, M=1 is supported   + The maximum value of KS is {1,2,3,4} and subject to UE capability     - The support for Rel-16 eType-II is a separate UE capability at least from the support for Rel-19 Type-I and Type-II codebook refinements   + FFS (RAN1#116bis): The support for M=2, and if so, the value of M={1, 2} is NW-configured via higher-layer (RRC) signaling, and if additional restriction(s) are needed   FFS: The determination of M reported beams  Note: Selection algorithm of CRI(s) from measurement of KS>1 NZP-CSI-RS resources is up to UE implementation. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 M  2. 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, 1024}  Component 3 candidate values: {2,3,4~~,5,6,7,8~~} | Optional with capability signalling | |
| OPPO [7] | |  | | --- | | **Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports,   * For Rel-15 Type-I Single Panel codebook, M is NW-configured via higher-layer (RRC) signaling with candidate value(s) of {1, …, min(4,KS)}   + The maximum value of M is subject to UE capability * For Rel-16 eType-II, M=1 is supported   + The maximum value of KS is {1,2,3,4} and subject to UE capability     - The support for Rel-16 eType-II is a separate UE capability at least from the support for Rel-19 Type-I and Type-II codebook refinements   + FFS (RAN1#116bis): The support for M=2, and if so, the value of M={1, 2} is NW-configured via higher-layer (RRC) signaling, and if additional restriction(s) are needed   FFS: The determination of M reported beams  Note: Selection algorithm of CRI(s) from measurement of KS>1 NZP-CSI-RS resources is up to UE implementation.  **Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports,   * When M>1, the M PMIs are independently calculated and indicated * with the Rel-16 eType-II codebook and KS={1,2,3,4}, support M=2 with a maximum of 16 ports per resource, R=1 only, and a maximum UCI payload of 1706 bits.   + The value of M={1, 2} is NW-configured via higher-layer (RRC) signalling   + The maximum value of M is subject to UE capability * on the configured KS>1 NZP CSI-RS resources, reuse the legacy IMR rule for the Rel-15 CRI-based reporting for NZP CSI-RS resource for interference measurement, i.e. only 1 NZP CSI-RS resource for interference measurement can be configured |   Based on the above agreement, only Ks={1,2,3,4} was agreed for CRI based CSI reporting with Rel-16 eType-II codebook. Hence, the candidate values of component 3 of FG 59-2-2-2 should not include {5,6,7,8}.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 M  2. 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, 1024}  Component 3 candidate values: {2,3,4} | Optional with capability signalling | |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-1 | CJTC Dd report | 1. Configured minimum quantization range for CJTC Dd reporting  2. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC Dd reporting  3. Supported value of scaling factor X for OCPU calculation | 2-35 | yes | n/a | CJTC Dd report is not supported | Per band and per BC | n/a | n/a | n/a | Component 1 candidate values: {half cyclic prefix, full cyclic prefix}  Component 2 candidate values: {32, 64, 128, 256}  Component 3 candidate values: {1, 2}  Note：OCPU =X.NTRP | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] | In this FG, the candidate values for component 1 are ‘half cyclic prefix’ and ‘full cyclic prefix’.    Which one among the candidate values for component 1 is a lower capability needs to be determined. Assuming the following capability indication   * Band 1: ‘full cyclic prefix’ * Band 2: ‘half cyclic prefix’ * CA-n1\_n2: ‘half cyclic prefix’   If ‘half cyclic prefix’ is treated as a lower capability than ‘full cyclic prefix’, then the actual supported capabilities for the two bands can be determined as follows:   * The actual supported capability for Band 1 in CA-n1\_n2 is ‘half cyclic prefix’ since ‘half cyclic prefix’ indicated for CA-n1\_n2 is a lower capability than ‘full cyclic prefix’ indicated for Band 1. * The actual supported capability for Band 2 in CA-n1\_n2 is ‘half cyclic prefix’ since ‘half cyclic prefix’ is indicated for both Band 2 and CA-n1\_n2.  1. For FG 59-2-3-1, for the purpose of determining actual supported capability when capabilities are signaled per band and per BC, ‘half cyclic prefix’ is a lower capability than ‘full cyclic prefix’. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-5 | CJTC Dd+FO report | 1. Configured minimum quantization range for CJTC Dd reporting  2. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC Dd reporting  3. Configured minimum quantization range for CJTC FO reporting  4. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC FO reporting  5. Supported value of scaling factor X for OCPU calculation | 2-35, 59-2-3-1, 59-2-3-2 | yes | n/a | CJTC Dd+FO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {half cyclic prefix, full cyclic prefix}  Component 2 candidate values: {32, 64, 128, 256}  Component 3 candidate values: {0.1ppm, 0.2ppm}  Component 4 candidate values: {16, 32, 256}  Component 5 candidate values: {1, 2}  Note: OCPU =2X.NTRP  Note: parts per million (ppm) of the carrier frequency | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-5 | CJTC Dd+FO report | 1. Configured minimum quantization range for CJTC Dd reporting  2. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC Dd reporting  3. Configured minimum quantization range for CJTC FO reporting  4. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC FO reporting  5. Supported value of scaling factor X for OCPU calculation | 2-35, 59-2-3-1, and 59-2-3-2 | yes | n/a | CJTC Dd+FO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {half cyclic prefix, full cyclic prefix}  Component 2 candidate values: {32, 64, 128, 256}  Component 3 candidate values: {0.1ppm, 0.2ppm}  Component 4 candidate values: {16, 32, 256}  Component 5 candidate values: {1, 2}  Note: OCPU =2X.NTRP  Note: parts per million (ppm) of the carrier frequency | Optional with capability signalling | |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 PUSCH  2. 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, 1024}  Note: Component 2 is reported per BC | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 PUSCH  2. 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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=2  3. 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 values  a. {48, 64}  b. {1, 2, …, 64}  c. {64, …, 256} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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=2  3. 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 values  a. {48, 64}  b. {1, 2, …, 64, 128, 256}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 values  a. {48, 64}  b. {1, 2, …, 64}  c. {64, …, 256} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 values  a. {48, 64}  b. {1, 2, …, 64, 128, 256}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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>1  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  3. 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 setting  4. 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 Doppler  codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate values  a. {1,2,4,8}  b. {48, 64,128}  c. {2,3,4 … 64}  d. {64, …, 256}  Component 3 Candidate values  a. {1,2,4,8}  b. {48, 64,128}  c. {4,8,12}  d. {64, …, 256} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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>1  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  3. 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 setting  4. 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 Doppler  codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate values  a. {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 values  a. {1,2,4,8}  b. {48, 64,128}  c. {4,8,12}  d. {64, …, 256} | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 Doppler  codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate values  a. {1,2,4,8}  b. {48, 64,128}  c. {2,3,4 … 64}  d. {64, …, 256, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 Doppler  codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate values  a. {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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

Others

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-11 | CJTC Dd buffering time for separate triggering of CJTC Dd and Rel-18 eType-II CJT | Supported CJTC Dd buffering time for separate triggering of CJTC Dd and Rel-18 eType-II CJT | 59-2-3-7a | yes | n/a | CJTC Dd buffering time is 0 for separate triggering of CJTC Dd and Rel-18 eType-II CJT | Per band and per BC | n/a | n/a | n/a | Candidate value: {2s, infinity} | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | **Proposal 2-2: Support the following newly-proposed UE feature groups for SRS port grouping.**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR MIMO phase 5 | 59-2-1-XX | Both groups of SRS ports for single-CW reception | Support UE antenna ports associated with both groups of SRS ports for single-CW reception | 59-2-1-8 | YES | N/A | UE antenna ports associated with only the first port group of the two SRS port groups are used for single-CW reception | Per-band and per-BC | N/A | N/A | N/A | Applicable to reception of PDSCH with single-CW (i.e. <= 4 layers), and non-PMI report hypotheses of rank1-to-4 | Optional with capability signaling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

## 3-antenna-port codebook-based transmissions

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |  | yes | n/a | Non-codebook based PUSCH transmission for 3TX is not supported | Per FSPC | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 3}  Component 2 candidate values: {1,2,3}  Component 3 candidate values: {1,2,3} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] | Regarding FG 59-3-1 (non-codebook based PUSCH transmission for 3TX for single-TRP), some revision on wording is needed as an editorial change.  **Proposal 2**. For FG 59-3-1, support to revise the description in Component 2.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 SRS resource set with usage set to ‘non-codebook’ for non-codebook based 3TX PUSCH  3. Maximum number of simultaneous transmitted SRS resources at one symbol |  | yes | n/a | Non-codebook based PUSCH transmission for 3TX is not supported | Per FSPC | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 3}  Component 2 candidate values: {1,2,3}  Component 3 candidate values: {1,2,3} | Optional with capability signalling | |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~ | yes | n/a | Non-codebook based PUSCH transmission for 3TX is not supported | Per FSPC | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 3}  Component 2 candidate values: {1,2,3}  Component 3 candidate values: {1,2,3} | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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  4. Codebook based PUSCH transmission with port 1003 disabled when 4 port SRS resources with port 1003 disabled are configured to the UE |  | yes | n/a | Codebook based PUSCH transmission for 3TX is not supported | Per FSPC | n/a | n/a | n/a | Component 1 candidate values: {1, 2,3}  Component 2 candidate values: {1,2}  Note: When configured according to Component 4, the number of ports supported by UE for transmission in an SRS resource is 3 | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] | For codebook-based UL transmission by a 3TX UE，the following agreements had been agreed in RAN1#117:   |  | | --- | | **Agreement**  For codebook-based UL transmission by a 3TX UE, subject to its capability,   * A 3TX UE may report a maximum number of 3 layers * A 3TX UE may report a maximum number of SRS ports of up to 3   Note: SRS resource definition is not changed nor the number of SRS ports in the SRS resource. |   However, only the first sub-bullet had been captured by the latest version of the UE capabilities related with codebook-based UL transmission by a 3TX UE, which corresponds to the first component of UE FG 59-3-2. From our perspective, it is needed to introduce a new component in the current UE FG 59-3-2 to capture the second sub-bullet of the above agreements, where a 3TX UE may report a maximum number of SRS ports of up to 3 for codebook-based UL transmission.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 supported SRS port per resource  ~~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 | Per FSPC | n/a | n/a | n/a | [Component 1 candidate values: {1, 2,3}]  [Component 2 candidate values: {1,2}]  [Component 3 candidate values: {1,2,3}]  Note: When configured according to Component 4, the number of ports supported by UE for transmission in an SRS resource is 3 | Optional with capability signalling |   ***Proposal 3.1: Introduce the above modifications for 3-antenna-port PUSCH transmission FGs.*** |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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  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 | Per FSPC | n/a | n/a | n/a | Component 1 candidate values: {1, 2,3}  Component 2 candidate values: {1,2}  Note: When configured according to Component 4, the number of ports supported by UE for transmission in an SRS resource is 3 | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. 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 to indicate SRS antenna switching downgrading capability. | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | * For FG 59-3-3, a new component ‘Supported downgrade antenna switching configurations’ should be added, and the candidate values should be combination (including empty) of {1T1R, 1T2R, 1T4R, 1T6R, 2T2R, 2T4R, 2T6R, 3T3R, 3T6R}.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL  4. Supported downgrade antenna switching configurations |  | 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}  Component 4 candidate values: combination (including empty) of {1T1R, 1T2R, 1T4R, 1T6R, 2T2R, 2T4R, 2T6R, 3T3R, 3T6R}  Note: This UE feature can be signalled together with srs-AntennaSwitching8T8R-r18, srs-AntennaSwitchingBeyond4RX-r17, supportedSRS-TxPortSwitch-v1610, or supportedSRS-TxPortSwitch to indicate SRS antenna switching downgrading capability. | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] | Regarding FG 59-3-1 (3T6R antenna switching) and FG 59-3-3a (3T3R antenna switching), it was agreed that downgrading indication is based on the existing FGs defined from Rel-15 (e.g., *srs-AntennaSwitching8T8R-r18*, *srs-AntennaSwitchingBeyond4RX-r17*, *supportedSRS-TxPortSwitch-v1610*, or *supportedSRS-TxPortSwitch*) as clarified in the Note. In addition, FG 59-3-3 can be one of downgrading indication options for FG 59-3-3a in the Note. However, in the Note of FG 59-3-3, there is no description on FG 59-3-3a as one of downgrading indication options. Since 3T3R can be applicable for UE equipped with 6RX, so the UE supporting FG 59-3-3 (3T6R antenna switching) can indicate FG 59-3-3a (3T3R antenna switching) as one of downgrading indication options. Hence, we would like to add the following description in the Note of FG 59-3-3.  **Proposal 1**. For FG 59-3-3, support to add the description (i.e., or 59-3-3a) in the Note for adding one of downgrading indication options, which is similar with the Note of FG 59-3-3a (i.e., or 59-3-3) as red highlighted.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. 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, supportedSRS-TxPortSwitch or 59-3-3a to indicate SRS antenna switching downgrading capability. | Optional with capability signalling | |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL  ~~[4. Support of 3T6R antenna switching configuration(s) as an allowing downgrading configuration of 4T8R]~~ | ~~FFS~~ | 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}  ~~[FFS: New component for downgrade antenna switching configurations or a new~~ Note: This UE feature can be signalled together with srs-AntennaSwitching8T8R-r18, srs-AntennaSwitchingBeyond4RX-r17, supportedSRS-TxPortSwitch-v1610, or supportedSRS-TxPortSwitch to indicate SRS antenna switching downgrading capability for a UE with 4Rx, 6Rx or 8Rx.~~]~~ | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL | 2-53 | yes | n/a | 3TX 3T3R 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, supportedSRS-TxPortSwitch or 59-3-3 to indicate SRS antenna switching downgrading capability for a UE with 4Rx, 6Rx or 8Rx  Note: ‘3T3R’ is only applicable for the UE equipped with 4Rx, 6Rx, or 8Rx antenna ports. | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] | Regarding FG 59-3-1 (3T6R antenna switching) and FG 59-3-3a (3T3R antenna switching), it was agreed that downgrading indication is based on the existing FGs defined from Rel-15 (e.g., *srs-AntennaSwitching8T8R-r18*, *srs-AntennaSwitchingBeyond4RX-r17*, *supportedSRS-TxPortSwitch-v1610*, or *supportedSRS-TxPortSwitch*) as clarified in the Note. In addition, FG 59-3-3 can be one of downgrading indication options for FG 59-3-3a in the Note. However, in the Note of FG 59-3-3, there is no description on FG 59-3-3a as one of downgrading indication options. Since 3T3R can be applicable for UE equipped with 6RX, so the UE supporting FG 59-3-3 (3T6R antenna switching) can indicate FG 59-3-3a (3T3R antenna switching) as one of downgrading indication options. Hence, we would like to add the following description in the Note of FG 59-3-3.  **Proposal 1**. For FG 59-3-3, support to add the description (i.e., or 59-3-3a) in the Note for adding one of downgrading indication options, which is similar with the Note of FG 59-3-3a (i.e., or 59-3-3) as red highlighted.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL | 2-53 | yes | n/a | 3TX 3T3R 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, supportedSRS-TxPortSwitch or 59-3-3 to indicate SRS antenna switching downgrading capability for a UE with 4Rx, 6Rx or 8Rx  Note: ‘3T3R’ is only applicable for the UE equipped with 4Rx, 6Rx, or 8Rx antenna ports. | Optional with capability signalling | |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL | ~~FFS~~ | yes | n/a | 3TX 3T3R 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, supportedSRS-TxPortSwitch or 59-3-3 to indicate SRS antenna switching downgrading capability for a UE with 4Rx, 6Rx or 8Rx  Note: ‘3T3R’ is only applicable for the UE equipped with 4Rx, 6Rx, or 8Rx antenna ports. | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 59-3-2 | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type A for codebook based | Per FS | n/a | n/a | n/a | Component 3 candidate values: {1,2} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | Per FS | n/a | n/a | n/a | Component 3 candidate values: {1,2} | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 59-3-1 | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type A for non-codebook based | Per FS | n/a | n/a | n/a | Component 3 candidate values: {1,2,3} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | Per FS | n/a | n/a | n/a | Component 3 candidate values: {1,2,3} | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 59-3-2, 11-5 | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type B for codebook based | Per FSPC | n/a | n/a | n/a | Component 3 candidate values: {1,2} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-3-2 and 11-5 | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type B for codebook based | Per FSPC | n/a | n/a | n/a | Component 3 candidate values: {1,2} | Optional with capability signalling | |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | Per FSPC | n/a | n/a | n/a | Component 3 candidate values: {1,2} | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 59-3-1, 11-5 | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type B for non-codebook based | Per FSPC | n/a | n/a | n/a | Component 3 candidate values: {1,2,3} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-3-1, and 11-5 | yes | n/a | M-TRP PUSCH repetition is not supported for 3TX PUSCH transmission with type B for non-codebook based | Per FSPC | n/a | n/a | n/a | Component 3 candidate values: {1,2,3} | Optional with capability signalling | |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | Per FSPC | n/a | n/a | n/a | Component 3 candidate values: {1,2,3} | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | Per FS | n/a | n/a | n/a | Candidate values: {1,2} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | Per FS | n/a | n/a | n/a | Candidate values: {1,2} | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

## Asymmetric DL sTRP/UL mTRP scenarios

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-1a | PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI state(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for joint DL/UL TCI state(s) | 23-1-1 | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI state(s) is not supported | Per band | n/a | Applicable only to FR1 | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-1a | PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI state(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for joint DL/UL TCI state(s) | 23-1-1, 23-1-1h | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI state(s) is not supported | Per band | n/a | Applicable only to FR1 | n/a |  | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-1b | PL offset for PUCCH/PUSCH/SRS power control for separate DL/UL TCI state(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for separate DL/UL TCI state(s) | 23-10-1 | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control under separate DL/UL TCI state(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-1b | PL offset for PUCCH/PUSCH/SRS power control for separate DL/UL TCI state(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for separate DL/UL TCI state(s) | 23-10-1, 23-1-1h | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control under separate DL/UL TCI state(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-2a | Path Loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | 23-1-1 | yes | n/a | Applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) is not supported | Per band | n/a | Applicable only to FR1 | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-2a | Path Loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | 23-1-1, 23-1-1h | yes | n/a | Applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) is not supported | Per band | n/a | Applicable only to FR1 | n/a |  | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-2b | Path Loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | 23-10-1 | yes | n/a | Applying path loss offset on PDCCH-order PRACH under separate DL/UL TCI state(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-2b | Path Loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | 23-10-1, 23-1-1h | yes | n/a | Applying path loss offset on PDCCH-order PRACH under separate DL/UL TCI state(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-3 | Two SRS closed-loop power control adjustment states separatefrom PUSCH | Support of two separate SRS closed loop indices separate from PUSCH |  | yes | n/a | Two separate SRS closed loop indexes is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-3 | Two SRS closed-loop power control adjustment states separatefrom PUSCH | Support of two separate SRS closed loop indices separate from PUSCH | 2-52 | yes | n/a | Two separate SRS closed loop indexes is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-4b | Support two TAs enhancement for inter-cell beam management operation | Support of two TAs without the restriction of multi-DCI based multi-TRP operation for inter-cell beam management | 23-1-1a | yes | n/a | Two TAs without the restriction of multi-DCI based multi-TRP operation for inter-cell beam management is not supported | Per FS | No | No | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] | The agreed UE capability is not captured in UE feature list yet. One possible option is to add the following FG.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-4c | Rx timing difference larger than CP length for Rel.19 two TA | 1. Support of the Rx timing difference between the two DL reference timings is larger than CP length for Rel.19 two TA | 59-4-4a or 59-4-4b | yes | n/a | The Rx timing difference between the two DL reference timings is larger than CP length for Rel.19 two TA is not supported | Per PF | n/a | n/a | n/a |  | Optional with capability signalling |   An alternative option is to reuse the legacy FG40-2-6 in Rel.18 two TA. If we go with this way, we think it is better to clarify to reuse the legacy FG by adding a note in FG59-4-4b, because the target scenario of these two FGs are different between Rel.18 two TA (with coresetPoolIndex) and Rel.19 two TA (without coresetPoolIndex).   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 40. NR\_MIMO\_evo\_DL\_UL | 40-2-6 | Rx timing difference larger than CP length | 1. Support of the Rx timing difference between the two DL reference timings is larger than CP length |  | *rxTimingDiff-r18* | *FeatureSetDownlinkPerCC-v1800* | n/a | n/a |  | Optional with capability signaling |   **Proposal 2: To capture an agreement of “Rx timing difference larger than CP length for Rel.19 two TA” in RAN1#120bis, select one from the following options.**   * **Alt.1: Add the following FG.**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-4c | Rx timing difference larger than CP length for Rel.19 two TA | 1. Support of the Rx timing difference between the two DL reference timings is larger than CP length for Rel.19 two TA | 59-4-4a or 59-4-4b | yes | n/a | The Rx timing difference between the two DL reference timings is larger than CP length for Rel.19 two TA is not supported | Per PF | n/a | n/a | n/a |  | Optional with capability signalling |  * **Alt.2: Add the following note to FG59-4-4b.**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-4b | Support two TAs enhancement for inter-cell beam management operation | Support of two TAs without the restriction of multi-DCI based multi-TRP operation for inter-cell beam management | 23-1-1a | yes | n/a | Two TAs without the restriction of multi-DCI based multi-TRP operation for inter-cell beam management is not supported | Per FS | No | No | n/a |  | Optional with capability signalling  Note: Support of “Rx timing difference larger than CP length for Rel.19 two TA” is reported by FG40-2-6. | |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-4d | PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on CRFA for inter-cell without CORESETPoolIndex | Support of PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on CRFA 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 for inter-cell is not supported without CORESETPoolIndex | Per FS | No | No | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] | From the outcome of RAN1#122 [2], the following remaining issue can be discussed in the upcoming meeting.  Regarding FG 59-4-4d (PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on CRFA for inter-cell without CORESETPoolIndex), some revision on wording is needed as an editorial change.  **Proposal 3**. For FG 59-4-4d, support to revise the description as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59-4-4d | PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on CFRA for inter-cell without CORESETPoolIndex | Support of PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on 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 CFRA for inter-cell is not supported without CORESETPoolIndex | Per FS | No | No | n/a |  | Optional with capability signalling | |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-7b | DCI format 2\_3 to indicate TPC for one of two separate SRS closed loop indexes | Support DCI format 2\_3 to indicate TPC for one of two separate SRS closed loop indexes. | 59-4-3 | yes | n/a | The function of DCI 2\_3 indicating TPC command for one of two separate SRS closed loop indexes is not supported. | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-7b | DCI format 2\_3 to indicate TPC for one of two separate SRS closed loop indexes | Support DCI format 2\_3 to indicate TPC for one of two separate SRS closed loop indexes. | 59-4-3, 8-6 | yes | n/a | The function of DCI 2\_3 indicating TPC command for one of two separate SRS closed loop indexes is not supported. | Per band | n/a | n/a | n/a |  | Optional with capability signaling | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 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 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] | In the last meeting, the following UE capability related agreements have been reached for asymmetric DL sTRP/UL mTRP scenarios:  For FG 59-4-9a and FG 59-4-9b, since indicating one of two separate SRS closed loop indexes is only supported when UE support two SRS closed loop indexes, the prerequisite of these two FGs should be FG 59-4-3.  ***Proposal 5.6: For FG 59-4-9a and FG 59-4-9b, the prerequisite is FG 59-4-3 and FG 59-4-8.***  ***In summary, introduce the following modifications.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 of two separate SRS closed loop index(es) under separate DL/UL TCI state mode | 59-4-3 and 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 of two separate SRS closed loop index(es) under joint TCI state mode | 59-4-3 and 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 | |
| ZTE Corporation/Sanechips [4] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 two separate SRS closed loop index(es) under separate DL/UL TCI state mode | 59-4-8, 23-10-1 | 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 two separate SRS closed loop index(es) under joint TCI state mode | 59-4-8, 23-1-1 | 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 | |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] | Regarding FG 59-4-9a (DCI format 1\_1 to indicate one of two separate SRS closed loop indexes under separate DL/UL TCI state mode) and FG 59-4-9b (DCI format 1\_1 to indicate one of two separate SRS closed loop indexes under joint TCI state mode), some revision on wording is needed as an editorial change.  **Proposal 4**. For FG 59-4-9a and FG 59-4-9b, support to revise the description as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 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 | | 59-4-9b | 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 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 | |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-11 | Support of including PL offset in the calculation of Type 1 PHR based on actual PUSCH transmission and Type 1 PHR based on reference PUSCH | Support including PL offset in the calculation of Type 1 PHR based on actual PUSCH transmission and Type 1 PHR based on reference PUSCH |  | Yes | n/a | PL offset in the calculation of Type 1 PHR is not supported | Per Band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-10 | Support of including PL offset in the calculation of Type 1 PHR based on actual PUSCH transmission and Type 1 PHR based on reference PUSCH | Support including PL offset in the calculation of Type 1 PHR based on actual PUSCH transmission and Type 1 PHR based on reference PUSCH |  | Yes | n/a | PL offset in the calculation of Type 1 PHR is not supported | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] |  |
| Ofinno [9] |  |
| Qualcomm Incorporated [10] |  |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

**Others**

|  |  |
| --- | --- |
| Company | Summary |
| Vivo [2] |  |
| Huawei/HiSilicon [3] |  |
| ZTE Corporation/Sanechips [4] |  |
| Nokia [5] |  |
| CATT [6] |  |
| OPPO [7] |  |
| Samsung [8] | In RAN1#120bis, the following agreement has been discussed and made, but relevant UE capability on yellow highlighted part below has not been introduced yet.   |  | | --- | | **Agreement in RAN1#120bis**   * For the scenario that the UE is configured with PL offset in joint/UL TCI state(s), when the UE is configured with rel-19 2 TAs, the UE maintains one single downlink reference timing * For the scenario that the UE is not configured with PL offset in joint/UL TCI state(s) and UE may expect to receive SSB from UL TRP(s), when the UE is configured with rel-19 2 TAs:   + The UE maintains two downlink reference timings;   + Baseline assumption for this feature is that Rx timing difference between two DL reference timings is no larger than one CP length, while it is subject to optional UE capability that the Rx timing difference between two DL reference timings can be assumed to be larger than CP length.   + The reference point for PRACH transmission is indicated as follows:     - if “PRACH association indicator” in DCI format 1\_0 is 0, the reference timing is the first detected path (in time) of one of the corresponding downlink reference signal(s) of DL TCI state(s) of the reference cell associated with the first TAG.     - if “PRACH association indicator” in DCI format 1\_0 is 1, the reference timing is the first detected path (in time) of one of the corresponding downlink reference signal(s) of DL TCI state(s) of the reference cell associated with the second TAG   + Above applies for the case UE is configured with *SSB-MTC-additionalPCI* |   Hence, we would like to support the following FG. Detail description and wording can be discussed during the upcoming meeting.  **Proposal 5**. Support the following FG to support RX timing difference between two DL reference timings larger than CP with Rel-19 two TA enhancement (which means two TA configuration without restriction on multi-DCI based multi-TRP operation.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59-4-12 | 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 | 59-4-4b | 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 | |
| Ofinno [9] | **Proposal#1: Regarding FG 59-4-2a and FG 59-4-2b, include the following UE capability as a prerequisite for each FG with updating the definition to cover asymmetric TRP operation as:**   |  | | --- | | **@ TS38.306 V18.5.0**  ***intraCellCrossTRP-PDCCH-OrderCFRA-r18***  Indicates whether the UE supports cross-TRP PDCCH order based on CFRA for intra-cell multi-DCI based mTRP.  A UE supporting this feature shall also indicate support of *multiDCI-IntraCellMultiTRP-TwoTA-r18*.  If the UE indicates Path Loss offset on PDCCH-order PRACH for joint or separate DL/UL TCI states, this feature applies to asymmetric TRP operation  ***interCellCrossTRP-PDCCH-OrderCFRA-r18***  Indicates whether the UE supports cross-TRP PDCCH order based on CFRA for inter-cell multi-DCI based mTRP.  A UE supporting this feature shall also indicate support of *multiDCI-InterCellMultiTRP-TwoTA-r18*.  If the UE indicates Path Loss offset on PDCCH-order PRACH for joint or separate DL/UL TCI states, this feature applies to asymmetric TRP operation |  |  | | --- | | **Reason for Proposal#1:**   * When PL offset is configured, since UL-only TRPs cannot perform downlink transmissions (e.g., only anchor TRP can), cross-TRP PDCCH order should be supported to perform PRACH on UL-only TRP. In other words, the anchor TRP transmits a PDCCH order triggering RACH on the UL-only TRP. The existing UE capability as shown in the above is limited to multi-DCI based mTRP, which is not applicable for asymmetric TRP operation. Therefore, to capture this functionality in FG 59-4-2a and FG 59-4-2b, it seems reasonable to update the definition of the UE capability and include it as a prerequisite for each FG.   **Related agreement(s):**   * See below for agreements saying that PDCCH-order PRACH is applicable in asymmetric TRP operation   **Agreement @116bis**  Support applying PL offset on PDCCH-order PRACH towards a UL TRP in FR1.   * Note: The DL reference timing determination for PDCCH-order PRACH transmission to an UL TRP is still based on the DL RS defined in current RAN4 specification * Above is subject to a separate UE capability signaling   **Agreement @119**  The answer to the Question 1 in LS R1-2409353 is:   * From the perspective of UE: if UE is configured with PL offset in joint/UL TCI state(s), UE does not expect to receive SSB from UL TRP(s), else, UE may expect to receive SSB from UL TRP(s). |   **Proposal#2: Add FG for SSB reception from UL TRP at least to determine Path Loss on PDCCH-order PRACH based on the agreement in RAN1#119 as shown above related agreement(s).**  **Proposal#3: Regarding Rel-19 2 TAGs in asymmetric TRP operation, consider the following two options as a starting point:**   * **Option 1: Update the definition of the existing UE capability (i.e. *spCell-TAG-Ind-r18*) to cover asymmetric TRP operation.** * **Option 2: Introduce a new UE capability that indicates support of indicating one of two TAG IDs configured in the SpCell via absolute TA command MAC CE in asymmetric TRPs.**  |  |  | | --- | --- | | **Reason for Proposal#3:**   * It has been agreed that the legacy (e.g., Rel-18) MAC-CE based TA adjustment for two TAGs will be used for Rel-19 two TAGs in asymmetric TRP operation. In Rel-18, absolute TA command MAC CE can be used for TA adjustment in two TAGs. For this, the UE needs to indicate the capability of receiving indication of one of the two TAGs in absolute TA command MAC CE. But the definition of this existing capability is limited to multi-DCI multi-TRP operation, which is not applicable for asymmetric TRP operation. Therefore, either the definition of the existing UE capability can be updated to cover asymmetric TRP operation, or a new UE capability is needed.  |  | | --- | | **@ TS38.306 V18.5.0**  ***spCell-TAG-Ind-r18***  Indicates whether the UE supports indicating one of two TAG IDs configured in the SpCell via absolute TA command MAC CE.  A UE that indicates support of this feature shall indicate support of *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18*. |   **Related agreement:**   * See below for agreement saying that MAC-CE based TA adjustment for two TAGs is applicable in asymmetric TRP operation   **Agreement @118bis**  Support 2TA for the asymmetric DL sTRP/UL mTRP deployment scenarios:   * Remove the restriction that *coresetPoolIndex* needs to be configured for the 2TA feature. * One downlink reference timing is supported and applied to both TAGs.   + (FFS) Note: UE autonomous TA adjustment is only applicable to the first TAG * One single *n-TimingAdvanceoffset* is configured and applied to both TAGs. * Any of the TCI states can be associated with any one of the two TAGs. * The RAR carrying TA adjustment for those 2 TAGs is reused for Rel-19 2TA * The MAC CE based TA adjustment for 2 TAGs is reused for Rel-19 2TA. * Introduce the optional UE capability of “Overlapping UL transmission reduction” for Rel-19 2TA   + If UE does not report this UE capability, UE does not expect two UL transmissions associated with different TAGs are overlapped. * FFS: UE does not expect that in intra-slot TDM PUSCH type-B repetition transmission, two consecutive repetitions associated with different TAGs are overlapped. |   **Proposal#4: Regarding the maximum number of TAGs across all CCs in a band combination, consider the following two options as a starting point:**   * **Option 1: Update the definition of the existing UE capability (i.e. *maxNumberTAG-AcrossCC-r18*) to cover asymmetric TRP operation.** * **Option 2: Introduce a new UE capability for indicating a maximum number of TAGs across all CCs in a band combination.**  |  |  | | --- | --- | | **Reason for Proposal#4:**   * Supporting two TAGs in asymmetric TRP operation has been agreed. In the existing capability, the UE indicates the maximum number of TAGs across all CCs in a band combination when the UE supports multi-DCI multi-TRP operation. However, similarly the multi-DCI multi-TRP operation is not applicable to asymmetric TRP operation. Therefore, either the definition of the existing UE capability can be updated to cover asymmetric TRP operation or a new UE capability indicating maximum number of TAGs across all CCs in a band combination when the UE supports asymmetric TRP operation is needed.  |  | | --- | | **@ TS38.306 V18.5.0**  ***maxNumberTAG-AcrossCC-r18***  Indicates the maximum number of TAGs across all CCs in a band combination when UE supports multi-DCI Multi-TRP operation with two TA enhancement.  …  A UE supporting this feature shall indicate support of *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18*. |   **Related agreement:**   * See below for agreement saying that 2TA operation is applicable in asymmetric TRP operation   **Agreement @118bis**  Support 2TA for the asymmetric DL sTRP/UL mTRP deployment scenarios: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-2a | Path Loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | 23-1-1,  20-2-4,  20-2-4a | yes | n/a | Applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) is not supported | ~~FFS~~  Per Band | ~~FFS~~  n/a | ~~FFS~~  Applicable only to FR1 | ~~FFS~~  n/a |  | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-4-2b | Path Loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | 23-10-1,  20-2-4,  20-2-4a | yes | n/a | Applying path loss offset on PDCCH-order PRACH under separate DL/UL TCI state(s) is not supported | ~~FFS~~  Per Band | ~~FFS~~  n/a | ~~FFS~~  n/a | ~~FFS~~  n/a |  | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-4-9a | SSB reception from UL-only TRP for joint DL/UL TCI state(s) | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for joint DL/UL TCI state(s) | 23-1-1 | yes | n/a | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for joint DL/UL TCI state(s) is not supported | FFS | FFS | FFS | FFS |  | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-4-9a | SSB reception from UL-only TRP for separate DL/UL TCI state(s) | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for separate DL/UL TCI state(s) | 23-10-1 | yes | n/a | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for separate DL/UL TCI state(s) is not supported | FFS | FFS | FFS | FFS |  | Optional with capability signalling | |
| Qualcomm Incorporated [10] | In previous RAN1 meeting, the UE features for asymmetric DL sTRP/UL mTRP were standardized with very good progress. In this section, we identify one new FG that is needed for the asymmetric DL sTRP/UL mTRP.  For the support of two TAs enhancement, separate UE FGs are introduced for intra-cell beam management and inter-cell beam management in RAN1#120 meeting. While for intra-cell beam management, another UE FG is needed for sDCI mTRP since support of two TAs for intra-cell beam management doesn’t mean the UE support two TAs for both sTRP and sDCI mTRP. It is possible that the UE may support two TAs for sDCI mTRP while not support two TAs for sTRP. The UE FG on two TAs for intra-cell beam management cannot achieve this. Therefore, we propose to introduce the following UE FG for two TAs:    **Proposal 4-1: Introduce the following FG for two TAs for sDCI mTRP:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-4c | Support two TAs enhancement for sDCI based intra-cell Multi-TRP operation | Support of two TAs without the restriction of multi-DCI based multi-TRP operation for sDCI based intra-cell Multi-TRP operation | 40-1-1 | yes | n/a | Two TAs without the restriction of multi-DCI based multi-TRP operation sDCI based intra-cell Multi-TRP operation is not supported | Per FS | No | No | n/a |  | Optional with capability signalling | |
| NTT DOCOMO, INC. [11] |  |
| Ericsson [12] |  |

# Discussion Items during RAN1 #122bis

After review of contributions submitted to RAN1 #122bis in this agenda item, the following topics were identified by the moderator for discussion during RAN1 #122bis.

**General comments**

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
|  |  |

## UE-initiated/event-driven beam management

After review of contributions submitted to RAN1 #122bis in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-1 | UE-initiated/event-driven beam management for Event-2 based measurement and report for Mode A | 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 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  6. Support the first PUCCH and second PUSCH from the same PUCCH group | 2-22, 2-24, 23-1-1 | yes | n/a | UEI/ED beam report is not supported for Event-2 and Mode A | Per band | n/a | n/a | n/a | Component 4 candidate values: {1, 2, …, 64}  Note For Component 4 and Component 5, an SSB can be associated with the serving cell PCI or a PCI other than the serving cell PCI  Note: Regarding Event-2, QCL RS(s) in indicated TCI state(s) and resources configured for component 4 are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Do not support. We usually avoid prerequisites that are really basic. |
| Apple | We prefer not to have detailed pre-requisite discussion.  At least 2-22 should be removed |
| Huawei, HiSilicon | No need. |

## CSI enhancements for up to 128 ports

After review of contributions submitted to RAN1 #122bis in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 resources  within one slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum rank  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum number of panels  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum number of panels  4. Max # of CSI-RS resource in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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  3. Supported maximum number of panels  4. Support 4 CSI-RS resources in a resource set  5. Supported processing capability  6. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combination 1-6  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. supported processing capability  7. Support 4 CSI-RS resources in a resource set  8. 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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Component 6 candidate value {Capability 1, Capability 2}  Component 8 candidate values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 values  a. {48, 64, 128}  b. {1, …, 64, 128, 256}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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=1  5. 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 values  a. {48, 64, 128}  b. {1, 2, …, 64}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combinations with M=1  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. Supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. Support of parameter combinations with M=1  3. Support of rank 1-2  4. Support R=1  5. 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=1  6. Supported processing capability  7. Max # of CSI-RS resource in a resource set  8. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Reuse legacy Z/Z’ values  OCPU = 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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 = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = YxN4xceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Yx KDOPPxceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = YxN4, when P/SP-CSI-RS is configured for CMR  OCPU = Yx KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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 = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {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 values  a. {1, …, 64}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = Y x N4, when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 slot  2. 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 codebook  4. Support parameter combinations with L=2,4  5. Support for rank = 1,2  6. Support 64 ports  7. 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  8. Supported processing capability  9. Value of Y for CPU occupation (OCPU = Y.N4), when P/SP-CSI-RS is configured for CMR  10. Value of Y for CPU occupation (OCPU = Y. KDOPP), when A-CSI-RS is configured for CMR  11. Support for the size of DD-basis, N4=1  12. Scaling factor for active resource counting Kp  13. 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 set  14. 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 values  a. {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 values  a. {1, …, 64, 128, 256}  b. {64, …, 256, 512, 768, 1024}  Note: For component of processing capability  Capability 1:  Legacy timeline  OCPU = Y x N4 x ceil(P/32) ), when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP x ceil(P/32)), when A-CSI-RS is configured for CMR  Capability 2:  Scale the legacy timeline by ceil(P/32) where P is the total number of ports across all the K aggregated CSI-RS resources  OCPU = Y x N4, when P/SP-CSI-RS is configured for CMR  OCPU = Y x KDOPP, when A-CSI-RS is configured for CMR  Note: maximum OCPU is 8  Note: 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Okay |
| Ericsson | Ok |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | One or more of {59-2-1-1, 59-2-1-1c} | yes | n/a | Group-specific 3-bit scaling factors is not supported | Per band and per BC | n/a | n/a | n/a | Candidate values: {’rank-1’, ‘rank-1 and rank-2’}  Note: 3-bit scaling applies only to the Type-I SP codebook  Note: for the purpose of determining actual supported capability when capabilities are signaled per band and per BC, ‘rank-1’ is a lower capability than ‘rank-1 and rank-2’ | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Support |
| Apple | Do not see the need for the added note |
| ZTE | Prefer to discuss it together with the LS on per band and per BC capability. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 codebook  2. Supported NES SD Type1 timeline from two timeline capabilities, for Rel-19 Type-I single-panel codebook  3 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Do not support addition of 3rd component. Don’t see a similar component in legacy NES features. |
| Qualcomm | This is just to reflect the following agreement under MIMO agenda:  **Agreement (RAN1#121, 2025-05)**  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, when configured with port subset indication (from the Rel-18 SD NES Type-1), the actual number of ports (the number of 1s in the *port-subsetIndicator* bitmap) can correspond to a supported value of PCSI-RS for the Rel-19 Type-I SP codebook (i.e. either 48, 64, or 128), or to a supported value of PCSI-RS for the Rel-15 Type-I SP codebook (i.e., either 2, 4, 8, 12, 16, 24, 32), respectively   * The supported number of ports for port subset of the full PCSI-RS ports, is according to UE capability |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 M  2. 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 M  2. 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-1 | CJTC Dd report | 1. Configured minimum quantization range for CJTC Dd reporting  2. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC Dd reporting  3. Supported value of scaling factor X for OCPU calculation | 2-35 | yes | n/a | CJTC Dd report is not supported | Per band and per BC | n/a | n/a | n/a | Component 1 candidate values: {half cyclic prefix, full cyclic prefix}  Component 2 candidate values: {32, 64, 128, 256}  Component 3 candidate values: {1, 2}  Note：OCPU =X.NTRP  Note: for the purpose of determining actual supported capability when capabilities are signaled per band and per BC, ‘half cyclic prefix’ is a lower capability than ‘full cyclic prefix’ | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Supported |
| Apple | Do not see the need for the added note |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 PUSCH  2. 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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=2  3. 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 values  a. {48, 64}  b. {1, 2, …, 64, 128, 256}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 values  a. {48, 64}  b. {1, 2, …, 64, 128, 256}  c. {64, …, 256, 512, 768, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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>1  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  3. 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 setting  4. 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 Doppler  codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate values  a. {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 values  a. {1,2,4,8}  b. {48, 64,128}  c. {4,8,12}  d. {64, …, 256} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 Doppler  codebook for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a | Component 2 candidate values  a. {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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Ok |
| Apple | Okay |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-11 | CJTC Dd buffering time for separate triggering of CJTC Dd and Rel-18 eType-II CJT | Supported CJTC Dd buffering time for separate triggering of CJTC Dd and Rel-18 eType-II CJT | 59-2-3-7a | yes | n/a | CJTC Dd buffering time is 0 for separate triggering of CJTC Dd and Rel-18 eType-II CJT | Per band and per BC | n/a | n/a | n/a | Candidate value: {2s, infinity} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Not support. We don’t have buffering time in specifications. So, don’t see the need for introducing this concept in UE capability discussion. |
| Apple | Prefer not to have this FG |
| ZTE | Support, because it cannot be assumed that UE can always buffer the CJTC-Dd report infinitely. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR MIMO phase 5 | 59-2-1-XX | Both groups of SRS ports for single-CW reception | Support UE antenna ports associated with both groups of SRS ports for single-CW reception | 59-2-1-8 | YES | N/A | UE antenna ports associated with only the first port group of the two SRS port groups are used for single-CW reception | Per-band and per-BC | N/A | N/A | N/A | Applicable to reception of PDSCH with single-CW (i.e. <= 4 layers), and non-PMI report hypotheses of rank1-to-4 | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Ericsson | Not sure if this is essenetial. Prefer not to introduce at this point. |
| Apple | Prefer not to have this FG |
| ZTE | Do NOT think this FG is needed. |

## 3-antenna-port codebook-based transmissions

After review of contributions submitted to RAN1 #122bis in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 SRS resource set ~~(SRS set use is configured as~~ with usage set to ‘non-codebook ’for non-codebook based 3Tx PUSCH ~~transmission)~~  3. Maximum number of simultaneous transmitted SRS resources at one symbol |  | yes | n/a | Non-codebook based PUSCH transmission for 3TX is not supported | Per FSPC | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 3}  Component 2 candidate values: {1,2,3}  Component 3 candidate values: {1,2,3} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Okay |
| Ericsson | Support, as the change appears to be editorial in nature. |
| ZTE | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 supported SRS port per resource  ~~4. Codebook based PUSCH transmission with port 1003 disabled when 4 port SRS resources with port 1003 disabled are configured to the UE~~ |  | yes | n/a | Codebook based PUSCH transmission for 3TX is not supported | Per FSPC | n/a | n/a | n/a | Component 1 candidate values: {1, 2,3}  Component 2 candidate values: {1,2}  Component 3 candidate values: {1,2,3}  Note: When configured according to Component 4, the number of ports supported by UE for transmission in an SRS resource is 3 | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not know why we need added component 3 |
| Ericsson | We do not think this change is necessary. First, support for a maximum of 1 or 2 SRS ports is already covered by the legacy FG 23-1-4.   |  |  |  |  | | --- | --- | --- | --- | | 23-1-4 | UE capability value reporting | 1. Supported UE capability value and corresponding max number of SRS ports for each UE capability value | Component 1 candidate values: Up to 4 value each with one value of {1,2,4}  Note: the reported list contains only unique value |   Accordingly, the proposed component will introduce redundancy.  Second, ambiguity may arise if the UE reports a maximum of 3 SRS ports, since a 3-port SRS is not defined for 3Tx PUSCH. This may need additional clarification in the specification.  Therefore, we support keeping the agreed component unchanged, as it clearly specifies that a 4-port SRS resource with port 1003 disabled can be configured for 3Tx codebook PUSCH, while the note clarifies the number of ports is 3 for SRS transmission. |
| ZTE | NOT needed. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. Report the entry number of the first-listed band with UL in the band combination that affects this DL  3. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL  4. Supported downgrade antenna switching configurations |  | 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}  Component 4 candidate values: combination (including empty) of {1T1R, 1T2R, 1T4R, 1T6R, 2T2R, 2T4R, 2T6R, 3T3R, 3T6R}  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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not see the need fdor component 4  The modified Note is okay |
| Ericsson | Component 4 seems to be redundant given the note. We prefer to have either one of them. |
| ZTE | Perfer to add component 4 and remove 59-3-3a in the note. |

## Asymmetric DL sTRP/UL mTRP scenarios

After review of contributions submitted to RAN1 #122bis in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-1a | PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI state(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for joint DL/UL TCI state(s) | 23-1-1, 23-1-1h | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI state(s) is not supported | Per band | n/a | Applicable only to FR1 | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not prefer extensive discussion of pre-requisite. For example, 23-1-1 is pre-requisite of 23-1-1h |
| QC | No need. |
| Huawei, Hisilicon | No need. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-1b | PL offset for PUCCH/PUSCH/SRS power control for separate DL/UL TCI state(s) | Support of applying path loss offset for PUCCH/PUSCH/SRS power controls for separate DL/UL TCI state(s) | 23-10-1, 23-1-1h | yes | n/a | PL offset for PUCCH/PUSCH/SRS power control under separate DL/UL TCI state(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not prefer extensive discussion of pre-requisite. |
| QC | No need. |
| Huawei, Hisilicon | No need |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-2a | Path Loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) | 23-1-1, 23-1-1h,  20-2-4,  20-2-4a | yes | n/a | Applying path loss offset on PDCCH-order PRACH for joint DL/UL TCI state(s) is not supported | Per band | n/a | Applicable only to FR1 | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not prefer extensive discussion of pre-requisite. |
| QC | No need. |
| Huawei, Hisilicon | No need |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-2b | Path Loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | Support of applying path loss offset on PDCCH-order PRACH for separate DL/UL TCI state(s) | 23-10-1, 23-1-1h, 20-2-4, 20-2-4a | yes | n/a | Applying path loss offset on PDCCH-order PRACH under separate DL/UL TCI state(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not prefer extensive discussion of pre-requisite. |
| QC | No need. |
| Huawei, Hisilicon | No need |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-3 | Two SRS closed-loop power control adjustment states separatefrom PUSCH | Support of two separate SRS closed loop indices separate from PUSCH | 2-52 | yes | n/a | Two separate SRS closed loop indexes is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not prefer extensive discussion of pre-requisite. |
| QC | No need. |
| Ericsson | No need. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Okay |
| QC | OK. |
| Huawei, Hisilicon | OK |
| Ericsson | OK |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-7b | DCI format 2\_3 to indicate TPC for one of two separate SRS closed loop indexes | Support DCI format 2\_3 to indicate TPC for one of two separate SRS closed loop indexes. | 59-4-3, 8-6 | yes | n/a | The function of DCI 2\_3 indicating TPC command for one of two separate SRS closed loop indexes is not supported. | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not prefer extensive discussion of pre-requisite. |
| QC | No need. |
| Huawei, Hisilicon | OK |
| Ericsson | No need. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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, 59-4-3, 23-10-1 | 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, 59-4-3, 23-1-1 | 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Do not prefer extensive discussion of pre-requisite. |
| QC | No need. |
| Huawei, Hisilicon | OK |
| Ericsson | Fine with the correction in the function description. Don’t see the need to update pre-requisite. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | It might be okay, but also not very necessary |
| QC | No need.  In Rel.18, the following UE capability was introduced:    Although Rel.18 two TAs is for mDCI mTRP, while the above UE capability is not conditioned on the mDCI mTRP, it is a separate UE capability without any prerequisite FG. Considering this, we can reuse the same UE capability for Rel.19. |
| Huawei, Hisilicon | OK |
| Ericsson | The two TA capability defined in Rel18 should be sufficient. No need for new UE capability. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-4c | Support two TAs enhancement for sDCI based intra-cell Multi-TRP operation | Support of two TAs without the restriction of multi-DCI based multi-TRP operation for sDCI based intra-cell Multi-TRP operation | 40-1-1 | yes | n/a | Two TAs without the restriction of multi-DCI based multi-TRP operation sDCI based intra-cell Multi-TRP operation is not supported | Per FS | No | No | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Okay to consider |
| QC | Support.  For the support of two TAs enhancement, separate UE FGs were introduced for intra-cell beam management and inter-cell beam management in previous RAN1 meeting. While for intra-cell beam management, another UE FG is needed for sDCI mTRP since support of two TAs for intra-cell beam management doesn’t mean the UE support two TAs for both sTRP and sDCI mTRP. It is possible that the UE may support two TAs for sDCI mTRP while not support two TAs for sTRP. |
| Huawei, Hisilicon | No support. Redundant with 59-4-4a |
| Ericsson | We are open for discussion. It is not so clear to us this is needed. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-9a | SSB reception from UL-only TRP for joint DL/UL TCI state(s) | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for joint DL/UL TCI state(s) | 23-1-1 | yes | n/a | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for joint DL/UL TCI state(s) is not supported | FFS | FFS | FFS | FFS |  | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-4-9a | SSB reception from UL-only TRP for separate DL/UL TCI state(s) | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for separate DL/UL TCI state(s) | 23-10-1 | yes | n/a | Receiving SSB from UL TRP at least to determine pathloss on PDCCH-order PRACH for separate DL/UL TCI state(s) is not supported | FFS | FFS | FFS | FFS |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| Apple | Why we need these FGs? If UE can receive SSB, why we need all the enhancement to begin with? |
| QC | Don’t see the need for these FGs. |
| Ericsson | No need for these FGs. |

# Conclusion

Agreements reached during RAN1 121 as part of this agenda item are summarized in [13].

# References

1. R1-2506427,Updated RAN1 UE features list for Rel-19 LTE after RAN1 #122, Moderators (AT&T, NTT DOCOMO, INC.)
2. R1-2506882, UE features for NR MIMO Phase 5, vivo
3. R1-2506924, UE features for NR MIMO Phase 5, Huawei/HiSilicon
4. R1-2507038, Discussion on UE features for NR MIMO Phase 5, ZTE Corporation/Sanechips
5. R1-2507073, NR MIMO Phase 5 UE features, Nokia
6. R1-2507127, Maintenance on UE features for NR MIMO Phase 5, CATT
7. R1-2507160, UE features for NR MIMO Phase 5, OPPO
8. R1-2507237, UE features for NR MIMO Phase 5, Samsung
9. R1-2507460, Views on UE features for NR MIMO Phase 5, Ofinno
10. R1-2507705, UE features for NR MIMO phase 5, Qualcomm Incorporated
11. R1-2507796, Discussion on MIMO UE features, NTT DOCOMO, INC.
12. R1-2507863, Discussion on UE features for NR MIMO Phase 5, Ericsson
13. R1-25nnnnn, Session Notes of AI 9.2, Ad-Hoc Chair (AT&T)