**3GPP TSG RAN WG1 #122 R1-2506227**

**Bengaluru, India, Aug 25th – 29th, 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 [122-R19-UE\_features] during RAN1 #122. According to the Chair’s Notes:

|  |
| --- |
| [122-R19-UE\_features] Email discussion on Rel-19 UE features – Ralf (AT&T), Naoya (DOCOMO), Ralf (AT&T)   * 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 #122 within the scope of [122-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 #122

The following is the moderator’s summary of contributions submitted to RAN1 #122 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 | FFS | 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 | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | * + 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. * For FG 59-1-1/4/5, the RS for event-detection and beam measurement/report should be counted in 16-1g/1g-1 which describes the general pool for L1 measurement (e.g., L1-RSRP, RLM, BFD/BFR, etc), and then the corresponding note should be provided accordingly as what we did for the corresponding enhancement in Rel-17/18.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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-1, QCL RS(s) in indicated TCI state(s) and Component-4 are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * Since UE-initiated beam reporting includes beam measurement and beam reporting, FG2-22 which is for aperiodic beam report on PUSCH and FG 2-24which is for SSB/CSI-RS based beam measurement should be supported as the prerequisite of FG59-1-1   **Proposal** 7**: Adopt the following changes marked in red for FG 59-1-1:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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 | Optional with capability signalling | |
| Huawei/HiSilicon [6] | For FG 59-1-1, we think there is no need to introduce a prerequisite for 59-1-1 and the FFS is column 5 should be removed.  ***Proposal 2.1: For FG 59-1-1, remove “FFS” in the fifth column.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~ | 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 | Optional with capability signalling | |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] | As the Rel-19 UEI/ED BM is specified under the unified TCI framework assuming both intra-cell and inter-cell beam measurement/reporting, supporting 23-1-1 and 23-1-2 as pre-requisites for FG 59-1-1 is straightforward.  **Proposal 1**. Support 23-1-1 and 23-1-2 as pre-requisite FGs for FG 59-1-1. |
| Ericsson [10] | * + There is no need for any pre-requisite feature group. The underlying functionality is very basic (e.g., aperiodic beam reporting, FG 2-22, which is mandatory), and we typically do not include that.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~ | UEI/ED beam report is not supported for Event-2 and Mode A | Per band | 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 | |
| OPPO [11] | One FFS is the pre-requisite for FG 59-1-1. The design of UE-initiated beam reporting of event-2/1/7 is based on unified TCI framework. For each event, the UE derive the RS for current beam based on the indicated TCI state. Thus to support the UE-initiated beam reporting, the UE should first support unified TCI framework.  ***Proposal 1: The pre-requisite for FG 59-1-1 is FG 23-1-1.*** |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  2-24, and 23-1-1 or 23-10-1 | 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 | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 FFS for other potential FG(s) | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 3 candidate values: [{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}] | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  2. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 2 candidate values: {0, 1} | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | * + The prerequisite FG 5-19 (which is to support CSI report on Type 1 CG PUSCH) is needed.   + For component 3, candidate values of {0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512} are needed according to the following agreement.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 ~~FFS for other potential FG(s)~~  , 5-19 | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 3 candidate values: ~~[~~{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}~~]~~ | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * According to the agreement of RAN1 #121, on beam reporting transmission procedure for UE-initiated/event-driven beam reporting, regarding the value of X symbols for determining available transmission occasion of the second UL channel on Mode-B, support {0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512} as RRC candidate values for X symbols FG 59-1-1 should be supported as the prerequisite of FG59-1-2 , no other FG is needed.   **Proposal** 8**: Adopt the following changes marked in red for FG 59-1-2:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 3 candidate values: ~~[~~{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}~~]~~ | Optional with capability signalling | |
| Huawei/HiSilicon [6] | The minimum value of X is subject to UE capability and the candidate values can be {0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}. Hence, the brackets of the candidate value of X in FG 59-1-2 should be removed.  ***Proposal 2.2: For FG 59-1-2, remove the brackets of the candidate value of X.***  We think the basic feature in 59-1-1 should be the only pre-requisite for FG 59-1-2 and FG 59-1-3. For FG 59-1-7, similar to our discussion prior to Proposal 2.3, the pre-requisite can be 59-1-3. Note that since the pre-requisite of 59-1-3 is 59-1-1, for a UE that supports 59-1-7, it is guaranteed that it also supports 59-1-1.  ***Proposal 2.4: FG 59-1-1 is the pre-requisite for FG 59-1-2 and FG 59-1-3.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value~~s~~ of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH~~]~~ | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 3 candidate values: ~~[~~{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}~~]~~ | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 3 candidate values: ~~[~~{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}~~]~~ | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + There is no need for any additional pre-requisite feature group.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 ~~FFS for other potential FG(s)~~ | UEI/ED beam report Mode-B is not supported | Per band | Component 3 candidate values: ~~[~~{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}~~]~~ | |
| OPPO [11] | Another FFS is whether additional FGs is needed in pre-requisite for FG 59-1-2. FG 59-1-2 is applied to all the event types: event 2, event 1 and event 7. FG 59-1-4 and FG 59-1-5 are used to indicate the supporting of Event 1 Mode A and Event 7 Mode B. FG 59-1-2 indicated the supporting of Mode B, which can be applied to any supported event. Since FG 59-1-1 has been added as the pre-requisite to FG 59-1-4 and FG 59 -1-5, there is no need to introduce additional FG as pre-requisite to FG 59-1-2.  ***Proposal 2: Using FG 59-1-1 as the pre-requisite for FG 59-1-2 is sufficient. No need to include other FGs.*** |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 3 candidate values: different X in symbols can be reported for different SCS  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  3. Supported minimum value~~s~~ of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component 3 candidate values: [{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}] | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * No need of other FGs as prerequisite since same feature(s) can be applied for both Mode A and Mode B. * Based on the agreement in the previous meeting, support Component 3 candidate values. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1 | 59-1-1 FFS for other potential FG(s) | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | 1. Support of UE-initiated/event-driven beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1  [2. Support a maximum number of timers to measure in parallel a maximum number of time windows] | 59-1-1 | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a | [Component 2 candidate values: {1, 2, …, 64}] | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * Regarding prerequisites of FG 59-1-3, no other FG is needed except FG 59-1-1.   **Proposal** 9**: Adopt the following changes marked in red for FG 59-1-3:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | 1. Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1 | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| CATT [5] |  |
| Huawei/HiSilicon [6] | We think the basic feature in 59-1-1 should be the only pre-requisite for FG 59-1-2 and FG 59-1-3. For FG 59-1-7, similar to our discussion prior to Proposal 2.3, the pre-requisite can be 59-1-3. Note that since the pre-requisite of 59-1-3 is 59-1-1, for a UE that supports 59-1-7, it is guaranteed that it also supports 59-1-1.  ***Proposal 2.4: FG 59-1-1 is the pre-requisite for FG 59-1-2 and FG 59-1-3.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | 1. Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1 | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1 | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + There is no need for any additional pre-requisite feature group.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1 | 59-1-1 ~~FFS for other potential FG(s)~~ | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1 | 59-1-1 | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | 1. Triggering UEI/ED beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1 | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * No need of other FGs as prerequisite since this feature should be applied for all event types (i.e., Event-2/1/7). * Based on the agreement in #120bis meeting, add another component for the supported maximum number of timers   + Candidate values: {1, 2, …, 64}, since we think this can refer to the maximum number of new beams |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-4 | UE-initiated/event-driven beam management for Event-1 based measurement and report for Mode A | 1. Support of Event-1 based measurement and report for Mode A that L1-RSRP of the current beam becomes worse than a configured threshold based on one event instance | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-1 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Note: the event definition  Event 1: Quality of the current beam is worse than a certain threshold | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | * For FG 59-1-1/4/5, the RS for event-detection and beam measurement/report should be counted in 16-1g/1g-1 which describes the general pool for L1 measurement (e.g., L1-RSRP, RLM, BFD/BFR, etc), and then the corresponding note should be provided accordingly as what we did for the corresponding enhancement in Rel-17/18.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-4 | UE-initiated/event-driven beam management for Event-1 based measurement and report for Mode A | 1. Support of Event-1 based measurement and report for Mode A that L1-RSRP of the current beam becomes worse than a configured threshold based on one event instance | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-1 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Note: the event definition  Event 1: Quality of the current beam is worse than a certain threshold  Note: Regarding Event-1, QCL RS(s) in indicated TCI state(s) are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  3. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  2. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s) | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | * For FG 59-1-1/4/5, the RS for event-detection and beam measurement/report should be counted in 16-1g/1g-1 which describes the general pool for L1 measurement (e.g., L1-RSRP, RLM, BFD/BFR, etc), and then the corresponding note should be provided accordingly as what we did for the corresponding enhancement in Rel-17/18.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  3. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s)  Note: Regarding Event-7, the number of QCL RS(s) in activated TCI state(s) are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  2 ~~3~~. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s) | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] | Additionally, same as FG 59-1-1, we propose to add a note to FG 59-1-5 to clarify that when used as the “current” beam RS for event evaluation and measurement/reporting, an SSB can be from the serving cell PCI and a PCI other than the serving cell PCI.  **Proposal 3**. Add the following red highlighted note to FG 59-1-5 to indicate support of inter-cell measurement/reporting on SSB for Event-7.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  3. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s)  Note: For Component 3, an SSB can be associated with the serving cell PCI or a PCI other than the serving cell PCI | Optional with capability signalling | |
| Ericsson [10] | * + Component 3 is superfluous. This is the part of the definition of event-7  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  ~~3. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively~~ | 59-1-1 | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s) | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  ~~3~~2. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s) | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-6 | First PUCCH and second PUSCH from different PUCCH groups | 1. 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | FFS | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-2 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI | 1. Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI | FG 59-1-3 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | The prerequisite FG 59-1-1 is needed upon the following agreement.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | ~~FFS~~  59-1-1 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-2 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] | ***Proposal 2.5: FG 59-1-3 is the pre-requisite for FG 59-1-7.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | ~~FFS~~  FG 59-1-3 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-2 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | 59-1-1  ~~FFS~~ | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-2 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] | **Proposal 4**. Support FG 59-1-1 as a pre-requisite for FG 59-1-7. |
| Ericsson [10] | * + As the specification now supports including the 1-bit condition for all events, it should be part of the feature group as well.   + Since this can be configured only with timer/counter, FG 59-1-3 is an appropriate prerequisite FG.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI ~~for Event-2~~ | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI ~~for Event-2~~ | ~~FFS~~  59-1-3 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported ~~for Event-2~~ | Per Band |  | |
| OPPO [11] | The FG 59-1-7 is only applicable to Event 2. Therefore, the pre-requisite can be FG 59-1-1.  ***Proposal 3: The pre-requisite of FG 59-1-7 is FG 59-1-1.*** |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 |  | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-2 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-2 | ~~FFS~~ 59-1-1 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-2 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * FG59-1-1 and FG59-1-3 should be prerequisite for the FG59-1-7. |

**Other**

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] | The “1-bit condition met indication” has been formally agreed for Event-2 but remained an FFS for Event-7 in RAN1 120-bis. However, based on an earlier agreement in RAN1 119 that “The additionally supported events will reuse the same design as event 2 – unless there is consensus to do otherwise”, the “1-bit condition met indication” is included as an optional part of Event-7 report in Clause 5.2.1.5.4.1c of 38.214. Similar to event 2, we find it reasonable to also support “1-bit condition met indication” for event 7 and, therefore, to introduce a new FG for it. Per the agreement in RAN1 120, this indicator can be present only if the time window is configured. Therefore, we think the pre-requisite of this FG should be both 59-1-5 (the support of Event-7) and 59-1-3 (the support of time window).  ***Proposal 2.3: Introduce a new FG for the support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-7. Pre-requisites of this FG are 59-1-5 and 59-1-3.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-8 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-7 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-7 | FG 59-1-3  FG 59-1-5 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-7 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-8 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-7 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-7 | 59-1-5 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-7 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] | Furthermore, we propose a separate FG to indicate whether the UE supports including current beam L1-RSRP in the UEI beam report.  **Proposal 2**. Support to add FG 59-1-8 as follows to indicate support of inclusion of current beam measurement(s) in UEI/ED beam report.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-8 | Inclusion of current beam measurement in UEI/ED beam report | Support of including the current beam L1-RSRP in the UEI/ED beam report | 59-1-1 | yes | n/a | Inclusion of current beam measurement in UEI/ED beam report is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-1-4a | UE-initiated/event-driven beam management for Event-1 based measurement and report for Mode B | 1. Support of Event-1 based measurement and report that L1-RSRP of the current beam becomes worse than a configured threshold based on one event instance  2. Supported values of X | 59-1-4 | yes | n/a | UE-initiated/event-driven beam management for Event-1 based measurement is not supported for Mode B | Per Band | n/a | n/a | n/a | Component 2 candidate values: different X in symbols can be reported for different SCS  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-1-5a | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode B | 1. Support of Event-7 that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  2. Maximum number of the configured RS(s) for new beam in the RS resource set  3. Supported values of X | 59-1-5 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode B | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q, 8-bit bitmap  Component 2 candidate values: {1, 2, ..., 64}  Component 3 candidate values: different X in symbols can be reported for different SCS  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-1-7 | Measurement resource for UE initiated beam report | Per slot limitations:   1. The max number of SSB/CSI-RS (1Tx) resources (sum of aperiodic/periodic/semi-persistent) across all CCs configured to measure L1-RSRP within a slot for UE initiated beam report 2. The max number of CSI-RS (2Tx) resources (sum of aperiodic/periodic/semi-persistent) across all CCs configured to measure L1-RSRP within a slot for UE initiated beam report   Memory limitations:   1. The max number of CSI-RS resources across all CCs configured for UE initiated beam report 2. The max number of aperiodic CSI-RS resources across all CCs configured for UE initiated beam report 3. The max number of CSI-RS resources in a CSI-RS resource set configured for new beam for UE initiated beam report   Other limitations:   1. Supported density of CSI-RS (CMR) |  | Yes | n/a | UE initiated beam report is not supported | Per band | n/a | n/a | n/a | Component 1: Candidate values {8, 16, 32, 64}  Component 2: Candidate values {0, 4, 8, 16, 32, 64}  Component 3: Candidate values {8, 16, 32, 64, 128}  Component 4: Candidate values {0, 2, 4, 8, 16, 32, 64}  Component 5: Candidate values {2, 4, 8, 16, 32, 64}  Component 6: Candidate values {'1 only', '3 only', '1 and 3'}  Note: The reference slot duration is the shortest slot duration defined for the FR where the reported band belongs  Note: For component 3, 4, 5  the configured CSI-RS resources for both active and inactive BWPs are counted  Note: For components 1, 2, a SSB/CSI-RS resource is counted within the duration of a reference slot in which the corresponding reference signals are transmitted | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-1-8 | Maximum N for UE initiated beam report | Support of UE initiated beam report with maximum N L1-RSRP values |  | Yes | n/a | Maximum N=1 | Per band | n/a | n/a | n/a | Candidate values {1, 2, 4} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-1-9 | Configuration that current beam is always reported for UE initiated beam report | Support RRC to configure that current beam is always reported for UE initiated beam report |  | Yes | n/a | RRC to configure that current beam is always reported for UE initiated beam report is not supported | Per band | n/a | n/a | n/a | Note: The reported current beam, if configured, is not counted in the N reported beams | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-1-10 | Supported measurement RS for UE-initiated/event-driven beam management | Supported measurement RS for UE-initiated/event-driven beam management | 59-1-1 or 59-1-4 or 59-1-5 | yes | n/a |  | Per band | n/a | n/a | n/a | Candidate value: {SSB, CSI-RS and SSB } | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

## 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-1** **(Enhanced Type-I SP codebook for 64 ports – Scheme-A):** **Change the** **corresponding candidate value from {1:8} to {2,4}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC** **simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-1a (Enhanced Type-I SP codebook for 48 ports – Scheme-A): Change the corresponding candidate value from {1:8} to {2,3}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-1b (Enhanced Type-I SP codebook for 128 ports – Scheme-A):** **Change Component 4 to “Support 4 CSI-RS resources in a resource set” and remove the candidate value** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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 | ~~FFS~~ Per band and per BC | ~~FFS~~ n/a | ~~FFS~~ n/a | ~~FFS~~ n/a | Component 2 candidate values  a. {1, …, 64}  b. {64, …1024}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-1c (Enhanced Type-I SP codebook for 64 ports – Scheme-B): Change the corresponding candidate value from {1:8} to {2,4}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-1d (Enhanced Type-I SP codebook for 48 ports – Scheme-B): Change the corresponding candidate value from {1:8} to {2,3}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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, …, 256}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-1e | Enhanced Type-I SP codebook for 128 ports – Scheme-~~b~~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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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, …, 256}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling | |
| MediaTek Inc. [4] | * **FG 59-2-1-1e (Enhanced Type-I SP codebook for 128 ports – Scheme-B): Change Component 4 to “Support 4 CSI-RS resources in a resource set” and remove the candidate value** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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 | ~~FFS~~ Per band and per BC | ~~FFS~~ n/a | ~~FFS~~ n/a | ~~FFS~~ n/a | Component 2 candidate values  a. {1, …, 64}  b. {64, …1024}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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, …, 256}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-2** **(Enhanced Type-I MP codebook for 64 ports): Change the corresponding candidate value from {1:8} to {2,4}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-2a (Enhanced Type-I MP codebook for 48 ports): Change the corresponding candidate value from {1:8} to {2,3}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-2b (Enhanced Type-I MP codebook for 128 ports): Change Component 4 to “Support 4 CSI-RS resources in a resource set” and remove the candidate value** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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, …1024}  Component 3 candidate value {2, 4}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. Max # of CSI-RS resource in a resource set  5. Supported processing capability | 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {1:8}  Component 5 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  b. {64, …, 256}  Component 6 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-3 (Extended Rel-16 eType-II codebook for 64 Tx ports):** **Add** **Component 7 “Max # of CSI-RS resource in a resource set” with candidate value {2,4}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] | Since up-to-4 CSI-RS resources can be aggregated, it has been agreed to extend the maximum candidate value of the max number of resources and the total number of Tx ports across all CCs to 256 and 1024, respectively, for Hybrid BF (CRI-based) with Rel-16 eType-II codebook. With the same consideration, we propose to extend the maximum candidate value of the max number of resources and the total number of Tx ports across all CCs to 256 and 1024, respectively, also for extended Rel-16 eType-II codebook for more than 32 Tx ports.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  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 = ceil(P/32) | Optional with capability signalling | |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  b. {64, …, 256}  Component 6 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  b. {64, …, 256}  Component 6 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-3a (Extended Rel-16 eType-II codebook for 48 Tx ports): Add Component 7 “Max # of CSI-RS resource in a resource set” with candidate value {2,3}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] | Since up-to-4 CSI-RS resources can be aggregated, it has been agreed to extend the maximum candidate value of the max number of resources and the total number of Tx ports across all CCs to 256 and 1024, respectively, for Hybrid BF (CRI-based) with Rel-16 eType-II codebook. With the same consideration, we propose to extend the maximum candidate value of the max number of resources and the total number of Tx ports across all CCs to 256 and 1024, respectively, also for extended Rel-16 eType-II codebook for more than 32 Tx ports.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  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 = ceil(P/32) | Optional with capability signalling | |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  b. {64, …, 256}  Component 6 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  b. {64, …, 256}  Component 6 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-3b (Extended Rel-16 eType-II codebook for 128 Tx ports): Add Component 7 “Support 4 CSI-RS resources in a resource set”** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] | Since up-to-4 CSI-RS resources can be aggregated, it has been agreed to extend the maximum candidate value of the max number of resources and the total number of Tx ports across all CCs to 256 and 1024, respectively, for Hybrid BF (CRI-based) with Rel-16 eType-II codebook. With the same consideration, we propose to extend the maximum candidate value of the max number of resources and the total number of Tx ports across all CCs to 256 and 1024, respectively, also for extended Rel-16 eType-II codebook for more than 32 Tx ports.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  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 = ceil(P/32) | Optional with capability signalling | |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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 | ~~FFS~~ Per band and per BC | ~~FFS~~ n/a | ~~FFS~~ n/a | ~~FFS~~ n/a | Component 5 candidate values  a. {1, …, 64}  b. {64, …, 1024}  Component 6 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | 59. NR\_MIMO\_Ph5 | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  b. {64, …, 256}  Component 6 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  Component 6 candidate value {Capability 1, Capability 2}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-4 (Extended Rel-17 FeType-II codebook with 64 Tx ports): Add Component 7 “Max # of CSI-RS resource in a resource set” with candidate value {2,4}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Component 6 candidate value {Capability 1, Capability 2}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  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 = ceil(P/32) | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-4a (Extended Rel-17 FeType-II codebook with 48 Tx ports): Add Component 7 “Max # of CSI-RS resource in a resource set” with candidate value {2,3}** * **Change CPU occupation in Capability 2 timeline from OCPU = ceil(P/32) to OCPU = 1** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  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 | |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-5 (Extended Rel-18 eType-II Doppler codebook for 64 Tx ports): Add Component 13 “Max # of CSI-RS resource in a resource set” with candidate value {2,4}** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-5a (Extended Rel-18 eType-II Doppler codebook for 48 Tx ports): Add Component 13 “Max # of CSI-RS resource in a resource set” with candidate value {2,3}** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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}  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}  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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] | * **FG 59-2-1-5b (Extended Rel-18 eType-II Doppler codebook for 128 Tx ports): Add Component 13 “Support 4 CSI-RS resources in a resource set”** * **Add the following component: “A list of supported combinations, each combination is {Max # of resources and total # of Tx ports} per CC simultaneously”** * **Add the following notes**   + **Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.**   + **Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33.** |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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, …, 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}  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 | 59. NR\_MIMO\_Ph5 | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for Type-I and Type II codebook enhancement for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | FFS | yes | n/a | 2-slot resource aggregation is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for Type-I and Type II codebook enhancement for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | At least one of {59-2-1-1, 59-2-1-1c, 59-2-1-2, 59-2-1-3, 59-2-1-4, 59-2-1-5} | yes | n/a | 2-slot resource aggregation is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for extended Type-I and Type II codebook ~~enhancement~~ for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | FFS | yes | n/a | 2-slot resource aggregation is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * Since two slots CSI-RS resources are supported for Rel-19 Type-I SP codebook, Rel-19 Type-I MP codebook, Rel-19 Type-II codebook, the prerequisite feature groups of FG 59-2-1-6 should be 59-2-1-1, 1a, 1b, 1c, 1d, 1e, 2, 2a, 2b, 3, 3a, 3b, 4, 4a, 5, 5a ,5b.   **Proposal 1: Adopt the following changes marked in red for FG 59-2-1-6:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for Type-I and Type II codebook enhancement for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | ~~FFS~~  59-2-1-1, 1a, 1b, 1c, 1d, 1e, 2, 2a, 2b, 3, 3a, 3b, 4, 4a, 5, 5a, or 5b | yes | n/a | 2-slot resource aggregation is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for Type-I and Type II codebook enhancement for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | 59-2-1-1, 1a, 1b, 1c, 1d, 1e, 2, 2a, 2b, 3, 3a, 3b, 4, 4a, 5, 5a, or 5b  ~~FFS~~ | yes | n/a | 2-slot resource aggregation is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisites for this group can be any one of the following:   59-2-1-1/1a/1b/1c/1d/1e  59-2-1-2/2a/2b  59-2-1-3/3a/3b  59-2-1-4/4a  59-2-1-5/5a/5b   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-1-6 | CSI-RS resource time domain restriction for Type-I and Type II codebook enhancement for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | ~~FFS~~  59-2-1-1/1a/1b/1c/1d/1e  59-2-1-2/2a/2b  59-2-1-3/3a/3b  59-2-1-4/4a  59-2-1-5/5a/5b | 2-slot resource aggregation is not supported | Per band and per BC |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for Type-I and Type II codebook enhancement for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports |  | yes | n/a | 2-slot resource aggregation is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for Type-I and Type II codebook enhancement for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | ~~FFS~~59-2-1-1, 1a, 1b, 1c, 1d, 1e, 2, 2a, 2b, 3, 3a, 3b, 4, 4a, 5, 5a, or 5b | yes | n/a | 2-slot resource aggregation is not supported | Per-band and per-BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * The pre-requisite includes: 59-2-1-1, 1c, 2, 3, 4, 5. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-7 | Group-specific 3-bit scaling factors for up to 128 ports | Support of group-specific 3-bit scaling factors | FFS | yes | n/a | Group-specific 3-bit scaling factors is not supported | 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 |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] | * Since group-specific 3-bit scaling factors are supported for Rel-19 Type-I SP codebook, the prerequisite feature groups of FG 59-2-1-6 should be 59-2-1-1, 1a, 1b, 1c, 1d, and 1e.   **Proposal 2: Adopt the following changes marked in red for FG 59-2-1-7:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-7 | Group-specific 3-bit scaling factors for up to 128 ports | Support of group-specific 3-bit scaling factors | ~~FFS~~  59-2-1-1, 1a, 1b, 1c, 1d, or 1e | 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 | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-2-1-1, 1a, 1b, 1c, 1d, or, 1e  ~~FFS~~ | 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 | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisites for this group can be any one of the following:   59-2-1-1/1a/1b/1c/1d/1e   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-1-7 | Group-specific 3-bit scaling factors for up to 128 ports | Support of group-specific 3-bit scaling factors | ~~FFS~~  59-2-1-1/1a/1b/1c/1d/1e | Group-specific 3-bit scaling factors is not supported | Per band and per BC | Candidate values: {’rank-1’, ‘rank-1 and rank-2’}  Note: 3-bit scaling applies only to the Type-I SP codebook | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-2-1-1 | 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 | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * The pre-requisite includes: 59-2-1-1, 1c. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | FFS | yes | n/a | SRS Port Grouping is not supported | Per FS | n/a | n/a | n/a | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | 23-8-3 | yes | n/a | SRS Port Grouping is not supported | Per FS | n/a | n/a | n/a | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | 23-8-3 (SRS antenna switching for >4Rx)  ~~FFS~~ | yes | n/a | SRS Port Grouping is not supported | Per FS | n/a | n/a | n/a | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for this FG is 23-8-3.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | ~~FFS~~  23-8-3 | SRS Port Grouping is not supported | Per FS | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | 2-38 | yes | n/a | SRS Port Grouping is not supported | Per FS | n/a | n/a | n/a | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping |  | yes | n/a | SRS Port Grouping is not supported | Per FS | n/a | n/a | n/a | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR MIMO phase 5 | 59-2-1-8 | SRS port grouping | Support of SRS port grouping | ~~FFS~~2-55 | YES | N/A | SRS port grouping is not supported | ~~[~~Per-band and per-BC~~]~~ | n/a | n/a | n/a | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | Optional with capability signaling | |
| NTT DOCOMO, INC. [15] | * The pre-requisite can be 2-55 (SRS Tx switch). * Per-band and per-BC. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [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 signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + Since the agreed pre-requisites for this FG have ‘Per-band and per-BC’, ‘Per-band and per-BC’ can be confirmed for this FG.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | NES SD Type1 for Rel-19 Type-I single-panel codebook is not supported | ~~[~~Per-band and per-BC~~]~~ | 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 | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 42-1 | 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 | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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:   * 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 | |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. | FFS | 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} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | 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} | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | 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} | Optional with capability signalling | |
| MediaTek Inc. [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 | FFS | 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 | |
| CATT [5] | * The prerequisite feature group is the FG for Type I single panel codebook, (i.e., FG 2-36).   **Proposal 3: Adopt the following changes marked in red for FG 59-2-2-1:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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 … ~~64~~ 256}  c. {64, …, 256, 1024} | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | 2-36 (Rel-15 Type I SP CB)  ~~FFS~~ | 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} | Optional with capability signalling | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-35 | 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 … ~~64~~ 256}  c. {64, …1024} | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these two FGs is 2-35. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. |  | 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} | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS~~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} | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * The pre-requisite can be 2-36 (Rel-15 Type I single panel codebook). |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. | FFS | 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} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | 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} | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | 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} | Optional with capability signalling | |
| MediaTek Inc. [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 | FFS | 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 | |
| CATT [5] | * The prerequisite feature group is the FG for Rel-16 eType II codebook, (i.e., FG 16-3a).   **Proposal 4: Adopt the following changes marked in red for FG 59-2-2-2:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS~~  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} | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | 16-3a (Rel-16 eType II CB)  ~~FFS~~ | 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} | Optional with capability signalling | |
| Xiaomi [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. | 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, …1024} | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these two FGs is 2-35.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS~~  2-35 | Hybrid BF (CRI-based) with Rel-16 eType-II codebook is not supported | Per band and per BC | 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} | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. |  | 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} | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS~~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} | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * The pre-requisite can be 16-3a (Rel-16 eType-II). |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | FFS | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | 59-2-2-1 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | 59-2-2-1 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] | * For FG 59-2-2-3a, the prerequisite feature group is hybrid BF (CRI-based) with Rel-15 Type-I SP codebook (i.e., FG 59-2-2-1). For FG 59-2-2-3b, the prerequisite feature group is hybrid BF (CRI-based) with Rel-16 eType-II codebook (i.e., FG 59-2-2-2).   **Proposal 5: Adopt the following changes marked in red for FG 59-2-2-3a, 59-2-2-3b:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | ~~FFS~~  59-2-2-1 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | 59-2-2-1  ~~FFS~~ | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for this FG is 59-2-2-1.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | ~~FFS~~  2-35 | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC |  | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | 59-2-2-1 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | FFS | FFS | FFS |  | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | 59-2-1 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | 1. Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook~~]~~ | ~~FFS~~59-2-2-1 or 59-2-2-2 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * The pre-requisite can be 59-2-2-1. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | FFS | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | 59-2-2-2 | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | 59-2-2-2 | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * For FG 59-2-2-3a, the prerequisite feature group is hybrid BF (CRI-based) with Rel-15 Type-I SP codebook (i.e., FG 59-2-2-1). For FG 59-2-2-3b, the prerequisite feature group is hybrid BF (CRI-based) with Rel-16 eType-II codebook (i.e., FG 59-2-2-2).   **Proposal 5: Adopt the following changes marked in red for FG 59-2-2-3a, 59-2-2-3b:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | FFS  59-2-2-2 | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | 59-2-2-2  ~~FFS~~ | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for this FG is 59-2-2-2.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | ~~FFS~~  59-2-2-2 | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC |  | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | 59-2-2-2 | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | FFS | FFS | FFS |  | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | 59-2-2 | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | ~~FFS~~59-2-2-1 or 59-2-2-2 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * The pre-requisite can be 59-2-2-2. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-3 | CJTC wideband PO report | 1. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC WB PO reporting  2. Supported value of scaling factor X for OCPU calculation | 2-35 | yes | n/a | CJTC PO report is not supported | Per band and per BC | n/a | n/a | n/a | Component 1 candidate values: {16, 32}  Component 2 candidate values: {1, 2}  Note：OCPU =X.NTRP | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-3 | CJTC wideband PO report | 1. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC WB PO reporting  2. Supported value of scaling factor X for OCPU calculation  3. Supported slot duration for NTRP P/SP CSI-RS occaions being confined in | 2-35 | yes | n/a | CJTC PO report is not supported | Per band and per BC | n/a | n/a | n/a | Component 1 candidate values: {16, 32}  Component 2 candidate values: {1, 2}  Note：OCPU =X.NTRP  Component 3 candidate values: {1, 2,…} | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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, …1024} | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-3-3-2 | Parameter combinations 7-8 for extended Rel-16 eType-II codebook for up to 128 ports | 1. Support of parameter combinations 7-8 for extended Rel-16 eType-II codebook for up to 128 ports | 59-2-1-3 | Yes | n/a | Parameter combinations 7-8 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | one or more of {59-2-1-3, 59-2-1-3a, 59-2-1-3b} | 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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  2. Support R=1  3. 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 | one or more of {59-2-1-3, 59-2-1-3a, 59-2-1-3b} | 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 3 candidate values  a. {48, 64,128}  b. {1，2, …, 64}  c. {64, …1024} | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-4 | CJTC subband PO report | 1. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC SB PO reporting  2. Configured minimum subband size in resource blocks for the CJTC subband PO report  3. Supported value of scaling factor X for OCPU calculation | 2-35 | yes | n/a | CJTC subband PO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {16, 32}  Component 2 candidate values: {1, 2, 4, 8, 16}  Component 3 candidate values: {1, 2}  Note：OCPU =X.NTRP | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-4 | CJTC subband PO report | 1. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC SB PO reporting  2. Configured minimum subband size in resource blocks for the CJTC subband PO report  3. Supported value of scaling factor X for OCPU calculation  4. Supported slot duration for NTRP P/SP CSI-RS occaions being confined in | 2-35 | yes | n/a | CJTC subband PO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {16, 32}  Component 2 candidate values: {1, 2, 4, 8, 16}  Component 3 candidate values: {1, 2}  Note：OCPU =X.NTRP  Component 4 candidate values: {1, 2,…} | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} | FFS | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} | 40-1-4 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} | 59-2-3-2 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-2-3-6a, 59-2-3-6b and 59-2-3-6c is FG for Unified TCI with joint DL/UL TCI update for single-DCI based intra-cell multi-TRP with single activated TCI codepoint per CC (i.e., FG 40-1-4).   **Proposal 6: Adopt the following changes marked in red for FG 59-2-3-6a, 59-2-3-6b and 59-2-3-6c:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} | ~~FFS~~  40-1-4 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} | 40-1-1 (Same as Scheme A and B)  ~~FFS~~ | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these FGs is 40-1-1  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} | ~~FFS~~  40-1-1 | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} |  | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Prerequisite FG: 59-2-3-1 (i.e., CJTC Dd report) for 6a, 59-2-3-2 (i.e., CJTC FO report) for 6b, and 59-2-3-6a and 59-2-3-6b for 6c, respectively |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} | FFS | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} | 40-1-4 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} | 59-2-3-1 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-2-3-6a, 59-2-3-6b and 59-2-3-6c is FG for Unified TCI with joint DL/UL TCI update for single-DCI based intra-cell multi-TRP with single activated TCI codepoint per CC (i.e., FG 40-1-4).   **Proposal 6: Adopt the following changes marked in red for FG 59-2-3-6a, 59-2-3-6b and 59-2-3-6c:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} | ~~FFS~~  40-1-4 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} | 40-1-1 (Same as Scheme A and B)  ~~FFS~~ | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these FGs is 40-1-1  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} | ~~FFS~~  40-1-1 | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} |  | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Prerequisite FG: 59-2-3-1 (i.e., CJTC Dd report) for 6a, 59-2-3-2 (i.e., CJTC FO report) for 6b, and 59-2-3-6a and 59-2-3-6b for 6c, respectively |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} | FFS | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} | 40-1-4 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} | 59-2-3-1 and 59-2-3-2 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-2-3-6a, 59-2-3-6b and 59-2-3-6c is FG for Unified TCI with joint DL/UL TCI update for single-DCI based intra-cell multi-TRP with single activated TCI codepoint per CC (i.e., FG 40-1-4).   **Proposal 6: Adopt the following changes marked in red for FG 59-2-3-6a, 59-2-3-6b and 59-2-3-6c:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} | ~~FFS~~  40-1-4 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} | 40-1-1 (Same as Scheme A and B)  ~~FFS~~ | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these FGs is 40-1-1  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} | ~~FFS~~  40-1-1 | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} |  | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Prerequisite FG: 59-2-3-1 (i.e., CJTC Dd report) for 6a, 59-2-3-2 (i.e., CJTC FO report) for 6b, and 59-2-3-6a and 59-2-3-6b for 6c, respectively |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | FFS | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 40-3-1-1, 59-2-3-1 | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | ~~1.~~ Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 59-2-3-1 and 40-3-1-1 | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * To enable the linkage, CJTC Dd report and Rel-18 eType-II CJT CSI report should be the prerequisite feature group for 59-2-3-7 and 59-2-3-7a. The prerequisite of 59-2-3-7 and 59-2-3-7a should be FG for CJTC Dd report (i.e., FG 59-2-3-1) and FG for Rel-18 eType-II CJT CSI report (i.e., FG 40-3-1-1).   **Proposal 7: Adopt the following changes marked in red for FG 59-2-3-7 and 59-2-3-7a:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | ~~FFS~~  59-2-3-1, 40-3-1-1 | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 59-2-3-1, 40-3-1-1 (eType II CJT CSI)  ~~FFS~~ | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these FGs is 2-35  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | ~~FFS~~  2-35 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC |  | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 59-2-3-1, 40-3-1-1 | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI |  | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Prerequisite FG: 40-3-1-1 (i.e., basic FG for Rel-16 eType-II based CJT) and 59-2-3-1 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | FFS | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 40-3-1-1, 59-2-3-1 | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 59-2-3-1 and 40-3-1-1 | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * To enable the linkage, CJTC Dd report and Rel-18 eType-II CJT CSI report should be the prerequisite feature group for 59-2-3-7 and 59-2-3-7a. The prerequisite of 59-2-3-7 and 59-2-3-7a should be FG for CJTC Dd report (i.e., FG 59-2-3-1) and FG for Rel-18 eType-II CJT CSI report (i.e., FG 40-3-1-1).   **Proposal 7: Adopt the following changes marked in red for FG 59-2-3-7 and 59-2-3-7a:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | ~~FFS~~  59-2-3-1, 40-3-1-1 | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 59-2-3-1, 40-3-1-1 (eType II CJT CSI)  ~~FFS~~ | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these FGs is 2-35  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | ~~FFS~~  2-35 | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC |  | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | 59-2-3-1, 40-3-1-1 | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI |  | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Prerequisite FG: 40-3-1-1 (i.e., basic FG for Rel-16 eType-II based CJT) and 59-2-3-1 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | FFS | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | 40-3-1-1, 59-2-3-1 | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | 59-2-3-7a | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * For the prerequisite of 59-2-3-8, considering the supportive of separate triggering is needed before introducing 1 bit indicate per trigger state, the prerequisite of 59-2-3-8 should be FG for Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering (i.e., FG 59-2-3-7a).   **Proposal 8: Adopt the following changes marked in red for FG 59-2-3-8:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type-II CJT reporting | ~~FFS~~  59-2-3-7a | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | 59-2-3-7a  ~~FFS~~ | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these FGs is 2-35  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | ~~FFS~~  2-35 | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and Per BC |  | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-8a | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | 59-2-3-8 | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | n/a | n/a | n/a | n/a |  | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting |  | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Prerequisite FG: 59-2-3-7a |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | FFS | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | 40-3-1-1, 59-2-3-1 | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | 59-2-3-7 | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * For the prerequisite of 59-2-3-10, considering the supportive of joint triggering is needed, the prerequisite of 59-2-3-10 should be FG for Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering (i.e., FG 59-2-3-7).   **Proposal 9: Adopt the following changes marked in red for FG 59-2-3-10:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxedtimeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | ~~FFS~~  59-2-3-7 | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax =0 | Per band and Per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | 59-2-3-7  ~~FFS~~ | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * + The pre-requisite for these FGs is 2-35  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | ~~FFS~~  2-35 | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | 59-2-3-7 | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax |  | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Prerequisite FG: 59-2-3-7 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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, …1024}  Note: Component 2 is reported per BC | 59. NR\_MIMO\_Ph5 | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-4d | Rank 3,4 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64ports | Support rank 3, 4 for extended Rel-17 FeType-II PS (port selection) codebook for up to 64ports | 59-2-1-4 | Yes | n/a | Rank 3, 4 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5d | DD unit size d=1 when A-CSI-RS is configured for CMR N4>1 for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Support value of d=1 for the DD unit size when A-CSI-RS is configured for CMR for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a | Value of d=1 for the DD unit size when A-CSI-RS is configured for CMR 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5e | Maximum number of aperiodic CSI-RS resources groups that can be configured in the same CSI report setting for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Supported maximum number of aperiodic CSI-RS resources groups that can be configured in the same CSI report setting for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Candidate values: {4, 8, 12} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. {48, 64,128}  b. {2,3,4 … 64}  c. {64, …, 256, 1024} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. {48, 64,128}  b. {2,3,4 … 64}  c. {64, …1024} | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5g | X=1 based on first and last slot of WCSI for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Support X=1 based on first and last slot of WCSI for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a | X=1 based on first and last slot of WCSI, 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5h | X=2 CQI based on 2 slots for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 1. Support X=2 CQI based on 2 slots for extended Rel-18 Type-II Doppler codebook for up to 128 ports  2. Support of TDCQI=’2’ | 59-2-1-5 | Yes | n/a | X=2 CQI based on 2 slots 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5i | l = (n – nCSI,ref ) for CSI reference slot for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 1. Support l = (n – nCSI,ref ) for CSI reference slot for extended Rel-18 Type-II Doppler codebook for up to 128 ports when N4=1 and d>1  2. Support of l = (n – nCSI,ref ) for CSI reference slot for Rel-18 Type-II Doppler codebook enhancement for up to 128 ports, when N4>1 | 59-2-1-5 | Yes | n/a | l = (n – nCSI,ref) for CSI reference slot 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5j | L=6 for CSI reference slot for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Support L=6 for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a | L=6 for CSI reference slot 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5k | Rank 3 and 4 for CSI reference slot for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Support Rank 3 and 4 for extenbded Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a | Rank 3 and 4 for CSI reference slot 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 |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-5k | Rank 3 and 4 for CSI reference slot for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Support Rank 3 and 4 for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a | Rank 3 and 4 for CSI reference slot 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 |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5l | Processing timeline for CSI reference slot for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 1. Aperiodic CSI report timing relaxation, w, extended Rel-18 Type-II Doppler codebook for up to 128 ports  2. Aperiodic CSI report timing relaxation, type, for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values:  UE reports candidate value, w, independently for each SCS in unit of symbols: {14\*(KP–1)\*d, 14\*KP\*d}  Note: Kp is according to Component 12 of FG59-2-5  Note: d=4 (minimum periodicity of periodic CSI-RS)  Component 2 candidate values: {CAP1, CAP2}  For N4 = 1  1) For AP CSI-RS: (Z,Z’) = (Z2 + 14\*( KDOPP –1)\*m, Z'2)  2) For P/SP CSI-RS: (Z,Z’) = (Z2 + w, Z'2)  For N4 > 1 and CAP1 in component 2  1) For AP CSI-RS: (Z,Z’) = (Z2 + 14\*( KDOPP –1)\*m, Z'2)  2) For P/SP CSI-RS: (Z,Z’) = (Z2 + w, Z'2)  For N4 > 1 and CAP2 in component 2  1) For AP CSI-RS: (Z,Z’) = (Z2 + 14\*( KDOPP –1)\*m + Z'2, 2Z'2)  2) For P/SP CSI-RS: (Z,Z’) = (Z2 + w + Z'2, 2Z'2)  Z2/Z'2 are defined in Table 5.4-2 in TS38.214  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  M = {1,2}, is the offset between two adjacent AP CSI-RS resource groups for the CMR in slots | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-5m | Maximum periodicity of CMR when configured as periodic CSI-Rs for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Supported maximum periodicity of CMR when configured as periodic CSI-Rs for extended Rel-18 Type-II Doppler codebook for up to 128 ports | 59-2-1-5 | Yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Candidate values (in slots): {4, 5, 8, 10, 20} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-5m | Maximum periodicity of CMR when configured as periodic CSI-Rs for extended Rel-18 Type-II Doppler codebook for up to 128 ports | Supported maximum periodicity of CMR when configured as periodic CSI-Rs for extended Rel-18 Type-II Doppler codebook for up to 128 ports9 | 59-2-1-5 | Yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Candidate values (in slots): {4, 5, 8, 10, 20} |  | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

**Other**

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | [59-2-2-4] | Configuration of MR always-reported resources for Type-I | Supported maximum number of MR for Type-I | 59-2-2-3a | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 for Type-I | Per band | n/a | n/a | n/a | Component candidate values: MR={1,2} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | [59-2-2-4a] | Configuration of MR always-reported resources for Rel-16 eType-II | For Rel-16 eType-II, MR={1} | 59-2-2-3b | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 for Rel-16 eType-II | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| MediaTek Inc. [4] | According to the following RAN1 agreements, group-based hard CBSR and 3-bit SD basis group-based scaling factor are supported for Rel-19 Type-I codebook refinement for 48, 64, and 128 CSI-RS ports. Then, according RAN1 conclusion, UE can report that it can support either the group-based hard CBSR, or the 3-bit SD basis group-based scaling factor, or both, or none of the two. However, in current UE feature list, the FG for group-based hard CBSR is missing, where only 3-bit SD basis group-based scaling factor has been captured in FG 59-2-1-7.   |  | | --- | | **Agreement**  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding CBSR design:   * 1-bit hard restriction is supported (analogous to Rel-15 Type-I) * FFS: 3-bit scaling factor for soft restriction with the scaling factor taken into account in CQI/PMI calculation * Moving (N1, N2) configuration out from CBSR IE and the CBSR can be optional configured   + Send LS to RAN2, and subject to RAN2 consent * -bit CBSR where each bit in the CBSR is associated with a set of X1X2 SD basis vectors, where the set includes X1 adjacent SD basis vectors along the N1 direction and/or X2 adjacent SD bases along the N2 direction   + FFS: Value(s) of X1 and X2 and detailed design/spec impact   FFS: Whether/how to enable shared CBSR in RRC configuration for Type-I/II codebooks with a same (N1,N2).  **Agreement**  For the Rel-19 Type-I codebook refinement for 48, 64, and 128 CSI-RS ports, for RI=v=1, support the following:   * for each group of SD basis vectors, a 3-bit scaling factor can be NW-configured via higher-layer (RRC) signalling, where the scaling factors are defined as scalings on the power control offset configured for the associated CSI-RS resources   + The values of and for this feature are separately configured from those for CBSR   + Separate configuration (RRC signalling) from CBSR   + The candidate values of and are the same as those agreed for CBSR * The codepoints of each of the group-specific 3-bit scaling factors are mapped to values of * Note: This feature is a separate UE capability   FFS: Whether this can be extended to RI=v>1 as well as Type-II codebook refinement  **Conclusion**  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, conditioned in UE capabilities, a UE can be configured with either the group-based hard CBSR, or the 3-bit SD basis group-based scaling factor, or both, or none of the two |   **Proposal 6:** **Support the following new FG for group-based hard CBSR to align the RAN1 agreement:**   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-X | Group-based hard CBSR | Support of group-based hard CBSR | FFS | yes | n/a | Group-based hard CBSR is not supported | Per band and per BC | n/a | n/a | n/a |  | |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-2-1-1f | CBSR for Rel-15 Type-I SP (single panel) codebook enhancement for up to 128 ports | Support CBSR for Rel-15 Type-I SP (single panel) codebook enhancement for up to 128 ports |  | Yes | n/a | CBSR for Rel-15 Type-I SP (single panel) codebook enhancement for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-1g | CSI-RS port mapping for Type-I and Type II codebook enhancement for up to 128 ports | Supported CSI-RS port mapping schemes for Type-I and Type II codebook enhancement for up to 128 ports |  | Yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Candidate value {Mapping method 1, Mapping method 2} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-1a | CJTC Dd report processing | 1. Maximum number of configured TRS resource sets for delay offset report  2. Maximum number of configured TRS resource sets for delay offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  3. Maximum number of simultaneously active CSI-RS resources for delay offset report per CC  4. Maximum number of simultaneously active CSI-RS resources for delay offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  5. Value of X for CPU occupation (OCPU=X⋅NTRP) | 59-2-3-1 | yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-1b | Maximum number of TRS resource sets in a report configuration for delay offset report | Maximum number of TRS resource sets in a report configuration for delay offset report | 59-2-3-1 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {2, 3, 4} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-1c | Maximum number of delay offset report settings per BWP | Maximum number of delay offset report settings (*CSI-ReportConfig)* configured with *resourcesForChannelMeasurement* linked to a same BWP ID | 59-2-3-1 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {1, 2, 3, 4} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-2a | CJTC FO report processing | 1. Maximum number of configured TRS resource sets for frequency offset report 2. Maximum number of configured TRS resource sets for frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC 3. Maximum number of simultaneously active CSI-RS resources for frequency offset report per CC 4. Maximum number of simultaneously active CSI-RS resources for frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC   6. Value of X for CPU occupation (OCPU=X⋅NTRP) | 59-2-3-2 | yes | n/a | CJTC FO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} |  | | 59. NR\_MIMO\_Ph5 | 59-2-3-2b | Maximum number of TRS resource sets in a report configuration for frequency offset report | Maximum number of TRS resource sets in a report configuration for frequency offset report | 59-2-3-2 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {2, 3, 4} |  | | 59. NR\_MIMO\_Ph5 | 59-2-3-2c | Maximum number of frequency offset report settings per BWP | Maximum number of frequency offset report settings (*CSI-ReportConfig)* configured with *resourcesForChannelMeasurement* linked to a same BWP ID | 59-2-3-2 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {1, 2, 3, 4} |  | | 59. NR\_MIMO\_Ph5 | 59-2-3-3a | CJTC wideband PO report processing | 1. Maximum number of configured CSI-RS resources for phase offset report 2. Maximum number of configured CSI-RS resources for phase offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC 3. Maximum number of simultaneously active CSI-RS resources for phase offset report per CC 4. Maximum number of simultaneously active CSI-RS resources for phase offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC   Value of X for CPU occupation (OCPU=X⋅NTRP) | 59-2-3-3 | yes | n/a | CJTC PO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-3b | Maximum number of CSI-RS resources in a report configuration for phase offset report | Maximum number of CSI-RS resources in a report configuration for phase offset report | 59-2-3-3 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {2, 3, 4} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-3c | Maximum number of phase offset report settings per BWP | Maximum number of phase offset report settings (*CSI-ReportConfig)* configured with *resourcesForChannelMeasurement* linked to a same BWP ID | 59-2-3-3 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {1, 2, 3, 4} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-5a | CJTC Dd+FO report processing | 1. Maximum number of configured TRS resource sets for joint delay and frequency offset report 2. Maximum number of configured TRS resource sets for joint delay and frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC 3. Maximum number of simultaneously active CSI-RS resources for joint delay and frequency offset report per CC 4. Maximum number of simultaneously active CSI-RS resources for joint delay and frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC   Value of X for CPU occupation (OCPU=2X⋅NTRP) | 59-2-3-5 | 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: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} | Optional with capability signalling | | 59. NR\_MIMO\_Ph5 | 59-2-3-9 | RRC configuration of 1 SRS port of antenna switching associated with phase offset report | Support of RRC configuration of 1 SRS port of antenna switching associate with phased offset report |  | Yes | n/a | RRC configuration of 1 SRS port of antenna switching associated with phase offset report is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR MIMO phase 5 | 59-2-2-XX | CSI-RS resource-specific RI restriction | Support of CSI-RS resource-specific RI restriction for Rel-19 CRI-based report | 59-2-2-1 or 59-2-2-2 | YES | N/A | RI restrictions need to be configured same for all CSI-RS resources in the resource set | Per-band and per-BC | N/A | N/A | N/A |  | Optional with capability signaling | | 59. NR MIMO phase 5 | 59-2-2-XX | CSI-RS resource-specific triggering offset | Support of CSI-RS resource-specific triggering offset for aperiodic CSI-RS | 59-2-2-1 or 59-2-2-2 | YES | N/A | Aperiodic triggering offsets for all CSI-RS resources in the resource set need to be same | Per-band and per-BC | N/A | N/A | N/A |  | Optional with capability signaling | |
| NTT DOCOMO, INC. [15] |  |

## 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 | 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-15 | 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for FG 59-3-1, which is the non-codebook based 3Tx, should be the basic feature for non-codebook based transmission, i.e., FG 2-15.   **Proposal 10: Adopt the following changes marked in red for FG 59-3-1:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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~~  2-15 | 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 | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-15  ~~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}  For SUL, uplink MIMO is not supported. | Optional with capability signalling | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Samsung [9] | Regarding FG 59-3-1 (Non-codebook based PUSCH transmission for 3TX for single-TRP),   * For pre-requisite, we would like to add FG 2-15 which is a basic non-codebook based PUSCH transmission defined in Rel-15.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-15 | 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 | |
| Ericsson [10] | `Similar to the Rel-18 feature supporting 8 Tx non-codebook based PUSCH (FG 40-7-2), which does not rely on any legacy UE capability FG, the 3 Tx non-codebook based transmission introduced in Rel-19 does not require any pre-requisite.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 40. NR\_MIMO\_evo\_DL\_UL | 40-7-2 | Basic features for Non-Codebook-based 8Tx PUSCH | 1. Maximum number of PUSCH MIMO layers for non-codebook based PUSCH  2. Maximum number of SRS resources per SRS resource set with usage set to 'nonCodebook’  3. Maximum number of simultaneous transmitted SRS resources at one symbol |  |  1. FG 59-3-1 is a new Rel-19 feature and does not require any pre-requisite, similar to the Rel-18 feature supporting 8 Tx non-codebook based PUSCH (FG 40-7-2). 2. Introduce no pre-requisite for FG 59-3-1. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * No pre-requisite is needed. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-3-1a | Association between CSI-RS and SRS for non-codebook-based 3Tx PUSCH transmission for single TRP | 1. Support the association between CSI-RS and SRS for non-codebook-based 3Tx PUSCH  2. A list of supported combinations, each combination is {Max # of Tx ports in one resource, Max # of resources, and total # of Tx ports} simultaneously | 59-3-1 | yes | n/a | Association between CSI-RS and SRS for non-codebook-based 3Tx PUSCH is not supported | Per band | n/a | n/a | n/a | Component 2 candidate value:  a. {2, 4, 8, 12, 16, 24, 32}  b. {1 to 64}  c. {2 to 256} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] | * Support 59-3-1 as pre-requisite. |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-14 | 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for FG 59-3-2, which is the codebook based 3Tx, should be the basic feature for codebook basedtransmission, i.e., FG 2-14   **Proposal 11: Adopt the following changes marked in red for FG 59-3-2:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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~~  2-14 | 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 | |
| Huawei/HiSilicon [6] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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  5.Maximum number of actual supported SRS ports per SRS resource is 3 | 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 | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-14  ~~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  For SUL, uplink MIMO is not supported. | Optional with capability signalling | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Samsung [9] | Regarding FG 59-3-2 (Codebook based PUSCH transmission for 3TX for single-TRP),   * For pre-requisite, we would like to add FG 2-14 which is a basic codebook based PUSCH transmission defined in Rel-15.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-14 | 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 | |
| Ericsson [10] | Similar to the Rel-18 feature supporting 8 Tx codebook based PUSCH (FG 40-7-1), which does not rely on any legacy UE capability FG, the 3 Tx codebook based transmission introduced in Rel-19 does not require any pre-requisite.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 40. NR\_MIMO\_evo\_DL\_UL | 40-7-1 | Basic features for Codebook-based 8Tx PUSCH | 1. Maximum number of PUSCH MIMO layers for codebook based PUSCH  2. Maximum number of 8 port SRS resources per SRS resource set with usage set to 'codebook’ for codebook-based 8Tx PUSCH  3. SRS 8 Tx ports—codebook |  |  1. FG 59-3-2 is a new Rel-19 feature and does not require any prerequisites, similar to the Rel-18 feature supporting 8 Tx Codebook based PUSCH (FG 40-7-1). 2. Introduce no pre-requisite for FG 59-3-2. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * No pre-requisite is needed. |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-8-3 | 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-AntennaSwitchingBeyond4RX-r17h to indicate SRS antenna switching downgrading capability for a UE with 4Rx, 6Rx or 8Rx. | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | FFS | yes | n/a | 3TX 3T6R antenna switching is not supported | FFS | FFS | FFS | FFS | 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}  ~~[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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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]~~ | 2-53  ~~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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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：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 | |
| Samsung [9] | Regarding FG 59-3-3 (3T6R Antenna switching),   * We think that either having new component for downgrade antenna switching configurations or having new note is fine. To align with the design for 3T3R, we slightly prefer to deleting component 4 and taking new note. * For pre-requisite, we would like to add FG 2-55 which is a basic SRS Tx switch defined in Rel-15.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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]~~ | 2-55 | 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 | |
| Ericsson [10] | For the 3T6R antenna switching capability, it remains FFS whether to introduce a new component to represent downgrading options or to signal 3T6R capability with legacy antenna switching mechanisms. Additionally, in RAN1#120-bis, a new component, i.e., Component 4, was placed under FFS. This component is intended to indicate that 3T6R antenna switching can serve as downgraded configurations of 4T8R.  Firstly, Component 4 and the accompanying note appear redundant, as both aim to define associated antenna switching capabilities reportable under the 3T6R framework. Secondly, given the current lack of consensus on how to represent associated antenna switching capabilities for 3T6R, we propose defining an explicit set of such capabilities within Component 1. This set includes {t1r1, t2r2, t1r2, t3r3, t2r4, t1r4, t2r6, t1r6, t3r6}, aligning with the Rel-17 antenna switching capability (i.e., FG 23-8-3). In this approach, the UE reports its supported combinations from the predefined set using a bitmap, and the network configures one of the reported antenna switching capability.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 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]~~ | Component 1 candidate values: a combination from the set {t1r1, t2r2, t1r2, t3r3, t2r4, t1r4, t2r6, t1r6, t3r6}  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.]~~ |  1. To prevent conflicting configurations when reporting antenna switching capabilities for 3T6R, an explicit set of supported antenna switching combinations, {t1r1, t2r2, t1r2, t3r3, t2r4, t1r4, t2r6, t1r6, t3r6}, can be defined for Component 1 of FG 59-3-3, consistent with Rel-17 antenna switching capability. The UE can report one or more supported combinations from this set via a bitmap, allowing the network to configure one of the valid options. 2. Include a set of antenna switching capabilities {t1r1, t2r2, t1r2, t3r3, t2r4, t1r4, t2r6, t1r6, t3r6} for Component 1 of FG 59-3-3.   FG 2-53 (SRS resources) can serve as pre-requisite for FG 59-3-3, where FG 2-53 encapsulates the basic SRS capabilities that are required for SRS transmission during antenna switching. This also aligns with Rel-18 antenna switching capability for 8T8R (FG 40-5-4), which has FG 2-53 as pre-requisite.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 40. NR\_MIMO\_evo\_DL\_UL | 40-5-4 | SRS 8 Tx ports—antenna switching | 1. Support of 8T8R for antenna switching  2. Downgrade antenna switching configurations  3. Report the entry number of the first-listed band with UL in the band combination that affects this DL  4. Report the entry number of the first-listed band with UL in the band combination that switches together with this UL | 2-53 |  |  |  |  | | --- | --- | --- | | 2-53 | SRS resources | 1) Maximum number of aperiodic SRS resources (configured to UE) per BWP  2) Maximum number of aperiodic SRS resources (configured to UE) per BWP per slot  3) Maximum number of periodic SRS resources (configured to UE) per BWP  4) Maximum number of periodic SRS resources (configured to UE) per BWP per slot  5) Maximum number of semi-persistent SRS resources (configured to UE) per BWP  6) Maximum number of semi-persistent SRS resources (configured to UE) per BWP per slot  7) Maximum number of SRS port per resource |  1. FG 59-3-3 can have FG 2-53 as pre-requisite, where FG 2-53 encapsulates the basic SRS capabilities that are required for SRS transmission during antenna switching. 2. Add FG 2-53 as pre-requisite for FG 59-3-3. |
| OPPO [11] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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}  Note: This UE feature can be signalled together with srs-AntennaSwitching8T8R-r18, srs-AntennaSwitchingBeyond4RX-r17, to indicate SRS antenna switching downgrading capability for a UE with 8Rx.] | Optional with capability signalling | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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: 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * Component 4 is not needed and should be removed. The Note is sufficient, i.e., this UE feature can be signaled together with legacy UE features. * Pre-requisite should be 2-53. In Rel-18 8Tx SRS antenna switching, the pre-requisite is 2-53. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-3-3-1 | Maximum 2 SP and 1 periodic SRS sets for 3T6R antenna switching | Support of maximum 2 SP SRS resource sets and maximum 1 periodic SRS resource set for 3T6R antenna switching | 59-3-3 | yes | n/a | Only maximum one SRS resource set for periodic SRS and maximum one SRS resource set for semi-persistent SRS for 3T6R is supported | Per FS | n/a | n/a | n/a | Note: The two SP-SRS resource sets are not activated at the same time | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] | Regarding FG 59-3-3-1 (Maximum 2 SP and 1 periodic SRS sets for 3T6R antenna switching) and FG 59-3-3a-1 (Maximum 2 SP and 1 periodic SRS sets for 3T3R antenna switching),   * For Type, we would like to define per FS which is same with FG 23-8-4 (*srs-AntennaSwitching2SP-1Periodic-r17*) and FG 40-5-5 (*srs-AntennaSwitching8T8R2SP-1Periodic-r18*). |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-8-3 | 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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  ~~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 | |
| Vivo [7] |  |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Samsung [9] | Regarding FG 59-3-3a (3T3R Antenna switching),   * For pre-requisite, we would like to add FG 2-55 which is a basic SRS Tx switch defined in Rel-15.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-55 | 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 | |
| Ericsson [10] | FG 2-53 (SRS resources) can serve as pre-requisite for FG 59-3-3a, where FG 2-53 encapsulates the basic SRS capabilities that is required for SRS transmission during antenna switching. This also aligns with Rel-18 antenna switching capability for 8T8R (FG 40-5-4), which has FG 2-53 as pre-requisite. FG 40-5-4 and FG 2-53 are listed in sub bullet ‘c’ above.   1. FG 59-3-3a can have FG 2-53 as pre-requisite, where FG 2-53 encapsulates the basic SRS capabilities that are required for SRS transmission during antenna switching. 2. Add FG 2-53 as pre-requisite for FG 59-3-3a. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * Pre-requisite should be 2-53. In Rel-18 8Tx SRS antenna switching, the pre-requisite is 2-53. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-3-3a-1 | Maximum 2 SP and 1 periodic SRS sets for 3T3R antenna switching | Support of maximum 2 SP SRS resource sets and maximum 1 periodic SRS resource set for 3T3R antenna switching | 59-3-3a | yes | n/a | Only maximum one SRS resource set for periodic SRS and maximum one SRS resource set for semi-persistent SRS for 3T3R is supported | Per FS | n/a | n/a | n/a | Note: The two SP-SRS resource sets are not activated at the same time | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1 | 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1  ~~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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Samsung [9] | Regarding FG 59-3-4 (M-TRP PUSCH repetition (type A) of 3-antenna-port PUSCH transmission – codebook based),   * For pre-requisite, we would like to add FG 2-14 which is a basic codebook based PUSCH transmission defined in Rel-15.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-14 | 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 | |
| Ericsson [10] | FG 59-3-2 (Codebook based PUSCH transmission with 3 Tx for single TRP) can serve as a pre-requisite for FG 59-3-4, since a UE that supports M-TRP PUSCH repetition (type A) of 3-antenna-port codebook based transmission depends on the components of 3 Tx codebook based single TRP transmission. This approach aligns with legacy behavior, where FG 23-3-1 (Multi-TRP PUSCH repetition (type A)-codebook based) has FG 2-14 (Codebook based PUSCH MIMO transmission) as the only pre-requisite.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-3-1 | Multi-TRP PUSCH repetition (type A) -codebook based | 1. Support of multi-TRP PUSCH repetition (based on PUSCH repetition type A)  - 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 | 2-14 |  |  |  |  | | --- | --- | --- | | 2-14 | Codebook based PUSCH MIMO transmission | 1) Supported codebook based PUSCH MIMO with maximal number of supported layers  2) Supported max number of SRS resource per set (SRS set use is configured as for codebook). |  1. Similar to legacy FG 23-3-1, FG 59-3-4 can have FG 59-3-2 as pre-requisite, since a UE that supports M-TRP PUSCH repetition (type A) of 3-antenna-port codebook based PUSCH transmission depends on the components of 3 Tx codebook based single TRP transmission. 2. Add FG 59-3-2 as pre-requisite for FG 59-3-4. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * Pre-requisite should be 59-3-2, i.e., Codebook based PUSCH for 3Tx for single TRP. |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1-2 | 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for FG 59-3-4a and FG 59-3-5a should be the basic feature for non-codebook based 3Tx, i.e., FG 59-3-1.   **Proposal 12: Adopt the following changes marked in red for FG 59-3-4a and FG 59-3-5a:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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~~  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 | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1-2  ~~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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Samsung [9] | Regarding FG 59-3-4a (M-TRP PUSCH repetition (type A) of 3-antenna-port PUSCH transmission – non-codebook based),   * For pre-requisite, we would like to add FG 2-15 which is a basic non-codebook based PUSCH transmission defined in Rel-15.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-15 | 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 | |
| Ericsson [10] | FG 59-3-1 (non-codebook based PUSCH transmission with 3 Tx for single TRP) can serve as a pre-requisite for FG 59-3-4a, since a UE that supports 3 Tx M-TRP non-codebook based PUSCH depends on the components of 3 Tx non-codebook based single TRP transmission. This approach aligns with legacy behaviour, where FG 23-3-1-2 (Multi-TRP PUSCH repetition (type A) non-codebook based) has FG 2-15 (non-codebook based PUSCH MIMO transmission) as the only pre-requisite.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-3-1-2 | Multi-TRP PUSCH repetition (type A) -non-codebook based | 1. Support of multi-TRP PUSCH repetition for non-codebook based PUSCH (based on PUSCH repetition type A)  - sequential mapping for repetitions larger than 2  - cyclic mapping for 2 repetitions  2. Support of two SRS resource sets with usage set to 'nonCodebook'  3. Supported number of SRS resources in one SRS resource set | 2-15 |  |  |  |  | | --- | --- | --- | | 2-15 | non-codebook based PUSCH transmission | 1) Maximal number of supported layers (non-codebook transmission scheme)  2) Supported max 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 |  1. Similar to legacy FG 23-3-1-2, FG 59-3-4a can have FG 59-3-1 as pre-requisite, since a UE that supports M-TRP PUSCH repetition (type A) of 3-antenna-port non-codebook based PUSCH transmission depends on the components of 3 Tx non-codebook based single TRP transmission. 2. Add FG 59-3-1 as pre-requisite for FG 59-3-4a. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * Pre-requisite should be 59-3-1, i.e., Non-codebook based PUSCH for 3Tx for single TRP. |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1-1 | 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1-1  ~~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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Samsung [9] | Regarding FG 59-3-5 (M-TRP PUSCH repetition (type B) of 3-antenna-port PUSCH transmission – codebook based),   * For pre-requisite, we would like to add FG 2-14 which is a basic codebook based PUSCH transmission defined in Rel-15 and FG 11-5 (PUSCH repetition Type B).  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-14 | 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 | |
| Ericsson [10] | FG 59-3-2 (Codebook based PUSCH transmission with 3 Tx for single TRP) and FG 11-5 (PUSCH repetition Type B) can serve as a pre-requisite for FG 59-3-5, since a UE that supports M-TRP PUSCH repetition (type B) of 3-antenna-port codebook based PUSCH transmission depends on the components of 3 Tx codebook based single TRP transmission and legacy PUSCH repetition Type B. This approach aligns with legacy behaviour, where FG 23-3-1-1 (Multi-TRP PUSCH repetition (type B)-codebook based) has FG 2-14 (Codebook based PUSCH MIMO transmission) and FG 11-5 as pre-requisites. FG 2-14 is shown in Sub bullet ‘e’ above.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-3-1-1 | Multi-TRP PUSCH repetition (type B) -codebook based | 1. Support of multi-TRP PUSCH repetition (based on PUSCH repetition 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 | 2-14, 11-5 |  |  |  |  | | --- | --- | --- | | 11-5 | PUSCH repetition Type B | 1. For a transport block, one dynamic UL grant or one configured grant schedules two or more PUSCH repetitions that can be in one slot, or across slot boundary in consecutive available slots.  2. Dynamic indication of the nominal number of repetitions in the DCI scheduling dynamic PUSCH.  3. The time window within which valid symbols are used for transmission is L\*K, starting from the first symbol indicated by the SLIV in TDRA field.  4. PUSCH repetition type B is supported for DCI format 0\_1 and DCI format 0\_2 (for DG and type 2 CG).  5. S and L are separately indicated (4-bit for S and 4-bit for L). L <= 14.  6. Handling of interaction with DL/UL directions depending on whether dynamic SFI is configured or not, including both cases with and without higher layer parameter InvalidSymbolPattern configured.  7. Supported maximum number of PUSCH transmissions within a slot for all TB(s), where each actual repetition for PUSCH repetition type B is counted as 1 PUSCH transmission, separately reported for UE processing capability 1 and for UE processing capability 2 if UE supports both processing capabilities.  Note: Number of TBs are based on reported Rel-15 capability on number of TBs, and reported value for component 7 cannot be smaller than the reported value of the number of TBs  Supported PUSCH hopping scheme |  1. Similar to legacy FG 23-3-1-1, FG 59-3-5 can have FG 59-3-2 and FG 11-5 as pre-requisite, since a UE that supports M-TRP PUSCH repetition (type B) of 3-antenna-port codebook based PUSCH transmission depends on the components of 3 Tx codebook based single TRP transmission and legacy PUSCH repetition Type B. 2. Add FG 59-3-2 and FG 11-5 as pre-requisite for FG 59-3-5. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * Pre-requisite should be 59-3-2, i.e., Codebook based PUSCH for 3Tx for single TRP. |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1-3 | 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 | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for FG 59-3-4a and FG 59-3-5a should be the basic feature for non-codebook based 3Tx, i.e., FG 59-3-1.   **Proposal 12: Adopt the following changes marked in red for FG 59-3-4a and FG 59-3-5a:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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~~  59-3-1 | 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 | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 23-3-1-3  ~~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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Samsung [9] | Regarding FG 59-3-5a (M-TRP PUSCH repetition (type B) of 3-antenna-port PUSCH transmission – non-codebook based)   * For pre-requisite, we would like to add FG 2-14 which is a basic codebook based PUSCH transmission defined in Rel-15 and FG 11-5 (PUSCH repetition Type B).  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 2-14 | 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 | |
| Ericsson [10] | FG 59-3-1 (non-codebook based PUSCH transmission with 3 Tx for single TRP) and FG 11-5 (PUSCH repetition Type B) can serve as a pre-requisite for FG 59-3-5a, since a UE that supports M-TRP PUSCH repetition (type B) of 3-antenna-port non-codebook based PUSCH transmission depends on the components of 3 Tx non-codebook based single TRP transmission and legacy PUSCH repetition Type B. This approach aligns with legacy behaviour, where FG 23-3-1-3 (Multi-TRP PUSCH repetition (type B) non-codebook based) has FG 2-15 (non-codebook based PUSCH MIMO transmission) and FG 11-5 as pre-requisites. FG 2-15 and FG 11-5 are shown in Sub bullet ‘f’ and Sub bullet ‘g’, respectively, above.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-3-1-3 | Multi-TRP PUSCH repetition (type B) -non-codebook based | 1. Support of multi-TRP PUSCH repetition (based on PUSCH repetition 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 'nonCodebook'  3. supported number of SRS resources in one SRS resource set | 2-15, 11-5 |  1. Similar to legacy FG 23-3-1-3, FG 59-3-5a can have FG 59-3-1 and FG 11-5 as pre-requisite, since a UE that supports M-TRP PUSCH repetition (type B) of 3-antenna-port non-codebook based PUSCH transmission depends on the components of 3 Tx non-codebook based single TRP transmission and legacy PUSCH repetition Type B. 2. Add FG 59-3-1 and FG 11-5 as pre-requisite for FG 59-3-5a. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * Pre-requisite should be 59-3-1, i.e., Non-codebook based PUSCH for 3Tx for single TRP. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 or59-3-2 | 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 | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59.  NR MIMO Phase 5 | 59-3-6 | Maximal supported number of PTRS ports of 3-antenna-port PUSCH transmission | Maximal supported number of ~~supported~~ PTRS ports ~~for~~ of 3-antenna-port PUSCH transmission | [59-3-1 ~~or]~~, 59-3-2, 59-3-4, 59-3-4a, 59-3-5, or 59-3-5a | yes | n/a | PTRS is not supported for 3TX PUSCH transmission | FFS | FFS | FFS | FFS | Candidate values: {1,2} | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * As the number of PTRS ports can be 1 or 2 for non-codebook based 3Tx, the prerequisite feature groups for FG 59-3-6 should include both the basic features for non-codebook and codebook based 3Tx, respectively. I.e., remove the bracket of FG 59-3-1 in the prerequisite for FG 59-3-6.   **Proposal 13: Adopt the following changes marked in red for FG 59-3-6:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Huawei/HiSilicon [6] |  |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 or59-3-2 | 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 | |
| Samsung [9] | Regarding FG 59-3-6 (PTRS of 3-antenna-port PUSCH transmission),   * We think that FG 59-3-1 could be one of pre-requisites since PTRS is also supported with non-codebook based transmission.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Ericsson [10] | At least one of FG 59-3-1 or FG 59-3-2 for non-codebook or codebook based PUSCH transmission with 3 Tx for single TRP can serve as a pre-requisite for FG 59-3-6, since the PTRS port(s) is only configured either when UE is capable of 3 Tx non-codebook or codebook based transmission.   1. FG 59-3-6 can have FG 59-3-1 or FG 59-3-2 as pre-requisite, since the PTRS port(s) is only configured either when UE is capable of 3 Tx non-codebook or codebook based transmission. 2. Add FG 59-3-1 or FG 59-3-2 as pre-requisite for FG 59-3-6. |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. [15] | * Pre-requisite should be 59-3-1 or 59-3-2. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR MIMO Phase 5 | 59-3-7 | UL full power transmission mode of *fullpower* | Support of full-power Mode 0 for codebook-based for 3 Tx operation | 59-3-2 | yes | n/a | UL full power transmission mode of *fullpower* is not supported | Per FS | n/a | n/a | n/a | Note: If a UE does not support this FG, Rel. 15 power scaling procedures apply | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

**Other**

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

## 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] | **[Asymmetric DL sTRP/UL mTRP scenarios]**  **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). | |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] | **[Asymmetric DL sTRP/UL mTRP scenarios]**  **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). | |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | FFS | 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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 | |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] | For FG 59-4-3, since two separate SRS closed loop indexes are only supported for asymmetric DL sTRP and UL mTRP scenario, the prerequisite should be FG 59-4-1a or FG 59-4-1b.  ***Proposal 5.1: The prerequisite of FG 59-4-3 is FG 59-4-1a or FG 59-4-1b.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-1a or 59-4-1b | yes | n/a | Two separate SRS closed loop indexes is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-1b  ~~FFS~~ | yes | n/a | Two separate SRS closed loop indexes is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-3 | Two SRS closed-loop power control adjustment states separate from 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 | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + No prerequisite is needed.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-4-3 | Two SRS closed-loop power control adjustment states separatefrom PUSCH | Support of two separate SRS closed loop indices separate from PUSCH | ~~FFS~~ | Two separate SRS closed loop indexes is not supported | Per band |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-3 | Two SRS closed-loop power control adjustment states separate from PUSCH | Support of two separate SRS closed loop indices separate from PUSCH | ~~FFS~~  23-1-1 | yes | n/a | Two separate SRS closed loop indexes is not supported | Per Band | n/a | n/a | n/a |  | Optional with capability signalling | |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “8-6 (TPC-SRS-RNTI)”, which indicates the support of one closed loop adjustment state for SRS. |

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

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] |  |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | FFS | 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 |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-4-4d and 59-4-5 should be FG for single-DCI based multi-TRP operation with two TA (i.e., FG 59-4-4 or 59-4-4a).   **Proposal 14: Adopt the following changes marked in red for FG 59-4-4d and 59-4-5:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  59-4-4 or 59-4-4a | 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 | |
| Huawei/HiSilicon [6] | For 59-4-4d, since it is applied only for two TA operation in sDCI case, the prerequisite should be FG 59-4-4a or FG 59-4-4b.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-4a or 59-4-4b  ~~FFS~~ | 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 | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-4d | PDCCH order~~ed~~ sent by one TRP triggers RACH procedure towards a different TRP based on ~~CRFA~~CFRA for inter-cell without CORESETPoolIndex | Support of PDCCH order~~ed~~ sent by one TRP triggers RACH procedure towards a different TRP based on ~~CRFA~~CFRA for inter-cell | 23-1-1a  ~~FFS~~ | yes | n/a | PDCCH order~~ed~~ 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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 CFRA for inter-cell | 59-4-4a | 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 | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + 59-4-4b Support two TAs enhancement for inter-cell beam management operation * Type   + Per Band , similar feature ***interCellCrossTRP-PDCCH-OrderCFRA-r18*** in release 18 is supported as per Band.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~ 59-4-4b | PDCCH ordered sent by one TRP triggers RACH procedure towards a different TRP based on CRFA for inter-cell is not supported without CORESETPoolIndex | ~~FS~~ Per band |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | For FG59-4-4d, to supported PDCCH order sent by one TRP to trigger RACH procedure towards a different TRP based on CFRA for inter-cell scenario, it was agreed to reuse the “PRACH association indicator” field in DCI format 1\_0 as shown below. Firstly, FG59-4-4d is needed only when two TAs are supported for inter-cell scenario. Secondly, the presence of “PRACH association indicator” field is conditioned on two TAs. Therefore, to support FG59-4-4d, the prerequisite FG should be FG59-4-4b, i.e., support two TAs enhancement for inter-cell beam management operation.  **Agreement**  For a UE provided with *SSB-MTC-AddtionalPCI* and not configured with multi-DCI based mTRP, support to reuse the DCI field ‘PRACH association indicator’ in DCI format 1\_0 to indicate PL RS for PDCCH-order PRACH:   * The bit field index 0 of this field indicates the DL RS that DMRS of PDCCH order DCI is QCLed with is used as PL RS for PRACH; * The bit field index 1 of this field is mapped to the additional PCI associated with the active TCI states and indicates the indicated SSB in this DCI is used as PL RS for PRACH:   + In this case, the PRACH configuration associated with addition PCI is used. * This DCI field is present when the corresponding RRC parameter is configured and multi-DCI based mTRP is not configured.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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 |   **Proposal 4-3: The prerequisite FG of FG59-4-4d is 59-4-4b.** |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “59-4-4b (two TA for inter-cell)”. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | FFS | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | 40-2-9, 59-4-4 | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | ~~FFS~~  59-4-4a or 59-4-4b | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-4-4d and 59-4-5 should be FG for single-DCI based multi-TRP operation with two TA (i.e., FG 59-4-4 or 59-4-4a).   **Proposal 14: Adopt the following changes marked in red for FG 59-4-4d and 59-4-5:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | ~~FFS~~  59-4-4 or 59-4-4a | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling | |
| Huawei/HiSilicon [6] | ***Proposal 5.2: The prerequisite of FG 59-4-5 is FG 59-4-4a or FG 59-4-4b.***  For FG 59-4-5, since it is applied only for two TA operation in sDCI case (there was already a similar FG for two TA operation in mDCI case), the prerequisite should be FG 59-4-4a or FG 59-4-4b.  ***Proposal 5.3: The prerequisite of FG 59-4-5 is FG 59-4-4a or FG 59-4-4b.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | 59-4-4a or 59-4-4b | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | 25-4-4a or 59-4-4b  ~~FFS~~ | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | 59-4-4a or 59-4-4b | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + 40-2-9: Overlapping UL transmission reduction   + 59-4-4: two TAs without restriction of multi-DCI based multi-TRP operation  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | ~~FFS~~40-2-9,59-4-4 | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement |  | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling | |
| Qualcomm Incorporated [14] | For FG 59-4-5, the prerequisite is the support of two TAs. Therefore, the prerequisite FG is one of FG59-4-4a, FG59-4-4b or FG59-4-4c.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | ~~FFS~~  59-4-4a, 59-4-4b or 59-4-4c | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling |   **Proposal 4-4: The prerequisite FG of FG59-4-5 is 59-4-4a or 59-4-4b or 59-4-4c.** |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “59-4-4a (two TA for intra-cell) or 59-4-4b (two TA for inter-cell)”, because this FG is only applicable for a UE supports two TA. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | FFS | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | 59-4-1a or 59-4-1b | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | ~~FFS~~  59-4-1a or 59-4-1b | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-4-6 should be FG for PL offset (i.e., FG 59-4-1 or 59-4-1a).   **Proposal 15: Adopt the following changes marked in red for FG 59-4-6:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | ~~FFS~~  59-4-1 or 59-4-1a | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Huawei/HiSilicon [6] | For FG 59-4-6, it is supported only when configuration of PL offset is supported. So, its prerequisite should be FG 59-4-1a or FG 59-4-1b.  ***Proposal 5.4: The prerequisite of FG 59-4-6 is FG 59-4-1a or FG 59-4-1b.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | 59-4-1a or 59-4-1b | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | 59-4-1b  ~~FFS~~ | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | 59-1-1a or 59-1-1b | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + 59-4-1a or 59-4-1b  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | ~~FFS~~ 59-4-1a or 59-4-1b | MAC-CE update of the configured PL offset value(s) is not supported | Per band and Per BC |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | 59-4-1a or 59-4-1b | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | ~~FFS~~  59-4-1a or 59-4-1b | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |   **Proposal 4-5: The prerequisite FG of FG 59-4-6 is 59-4-1a or 59-4-1b.** |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “59-4-1a, 59-4-1b, 59-4-2a, or 59-4-2b” because this FG is only applicable for a UE supports PL-offset. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-7a | Extended value range of starting bit of block in DCI format 2\_3 | Support of the extended value range of starting bit of DCI format 2\_3 | 8-6 | yes | n/a | The extended value range of starting bit of DCI format 2\_3 is not supported | Per band | n/a | n/a | n/a | Note: The starting bit of value range extends to X=45 for operations in FR1 in shared spectrum or FR2-2 and X = 43 otherwise | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + 59-4-3 Two SRS closed-loop power control adjustment states separatefrom PUSCH  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-4-7a | Extended value range of starting bit of block in DCI format 2\_3 | Support of the extended value range of starting bit of DCI format 2\_3 | 8-6, 59-4-3 | The extended value range of starting bit of DCI format 2\_3 is not supported | Per band and Per BC | Note: The starting bit of value range extends to X=45 for operations in FR1 in shared spectrum or FR2-2 and X = 43 otherwise | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-7a | Extended value range of starting bit of block in DCI format 2\_3 | Support of the extended value range of starting bit of DCI format 2\_3 | 8-6 | yes | n/a | The extended value range of starting bit of DCI format 2\_3 is not supported | Per band | n/a | n/a | n/a | Note: The starting bit of value range extends to X=45 for operations in FR1 in shared spectrum or FR2-2 and X = 43 otherwise | Optional with capability signalling | |
| Qualcomm Incorporated [14] |  |
| NTT DOCOMO, INC. [15] |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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. | FFS | 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 |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | 59-4-1a or 59-4-1b | 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 | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS~~  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 | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-4-7b, 59-4-9a and 59-4-9b should be FG for two SRS closed-loop power control adjustment states separate from PUSCH (i.e., FG 59-4-3).   **Proposal 16: Adopt the following changes marked in red for FG 59-4-7b, 59-4-9a and 59-4-9b:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS~~  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 | |
| Huawei/HiSilicon [6] | For FG 59-4-7b and FG 59-4-8, since indication of TPC for separate SRS CLPC adjustment state is only supported when UE support two SRS closed loop indexes, the prerequisite of these two FGs should be FG 59-4-3.  ***Proposal 5.5: For FG 59-4-7b and FG 59-4-8, the prerequisite is FG 59-4-3.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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  ~~FFS~~ | 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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. |  | 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 | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + 59-4-3 Two SRS closed-loop power control adjustment states separatefrom PUSCH  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS,~~ 59-4-3 | The function of DCI 2\_3 indicating TPC command for one of two separate SRS closed loop indexes is not supported. | Per band and Per BC |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. |  | 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 | |
| Qualcomm Incorporated [14] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | ~~FFS~~  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 |   **Proposal 4-6: The prerequisite FG of FG59-4-7b is FG8-6 (TPC-SRS-RNTI).** |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “59-4-3”, because it is only applicable to a UE supports two CL-PC adjustment states. * This FG can be reported per band. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | FFS | yes | n/a | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | 59-4-1a or 59-4-1b | yes | n/a | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] | For FG 59-4-7b and FG 59-4-8, since indication of TPC for separate SRS CLPC adjustment state is only supported when UE support two SRS closed loop indexes, the prerequisite of these two FGs should be FG 59-4-3.  ***Proposal 5.5: For FG 59-4-7b and FG 59-4-8, the prerequisite is FG 59-4-3.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | 59-4-3 | yes | n/a | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | 59-4-3  ~~FFS~~ | yes | n/a | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | 59-4-3 | yes | n/a | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + No prerequisite is needed.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | ~~FFS~~ | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band and per BC |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state |  | yes | n/a | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | For FG59-4-8, the FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) and also whether to have one FG is “DCI format 1\_1 for TPC command indication for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states is not needed considering FG59-4-9a and FG59-4-9b have been agreed to indicate one of two separate SRS closed loop indexes for the case of two separate SRS CLPC adjustment states.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) | Support of DCI format 1\_1 to indicate TPC for separate SRS closed loop index(es) | ~~FFS~~ | yes | n/a | DCI 1\_1 indicating TPC command for separate SRS closed loop index(es) is not supported | ~~FFS~~  Per band | ~~FFS~~  No | ~~FFS~~  No | ~~FFS~~  n/a | ~~FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) and also whether to have one FG is “DCI format 1\_1 for TPC command indication for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states”~~ | Optional with capability signalling |   **Proposal 4-7: Regarding the FFS in FG59-4-8, FG59-4-9a and FG59-4-9b, our view is provided as follows:**   * **For FG59-4-8,**    + **The prerequisite FG is not needed.**   + **The type is per band.**   + **FDD/TDD differentiation is not needed.**   + **FR1/FR2 differentiation is not needed.**   + Remove the FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) and also whether to have one FG is “DCI format 1\_1 for TPC command indication for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states in FG59-4-8. |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “8-3 (Basic power control operation)”, but it is ok to specify as “No”, because FG8-3 is mandatory without capability signaling. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | FFS | 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-1b | 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 | |
| ZTE Corporation/Sanechips [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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 | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-4-7b, 59-4-9a and 59-4-9b should be FG for two SRS closed-loop power control adjustment states separate from PUSCH (i.e., FG 59-4-3).   **Proposal 16: Adopt the following changes marked in red for FG 59-4-7b, 59-4-9a and 59-4-9b:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 TPC for one of two separate SRS closed loop index(es) under separate DL/UL TCI state mode | ~~FFS~~  59-4-3 | 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 | |
| Huawei/HiSilicon [6] | 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.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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 | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-3  ~~FFS~~ | 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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-3 | 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 | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + 23-10-1 Unified TCI with separate DL/UL TCI update for intra-cell beam management  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~23-10-1, | DCI 1\_1 indicating one of two separate SRS closed loop indexes under separate DL/UL TCI state mode is not supported |  |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | For FG59-4-8, the FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) and also whether to have one FG is “DCI format 1\_1 for TPC command indication for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states is not needed considering FG59-4-9a and FG59-4-9b have been agreed to indicate one of two separate SRS closed loop indexes for the case of two separate SRS CLPC adjustment states.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  59-4-3 | 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 |   **Proposal 4-7: Regarding the FFS in FG59-4-8, FG59-4-9a and FG59-4-9b, our view is provided as follows:**   * **The prerequisite FG of FG 59-4-9a and FG 59-4-9b is FG59-4-3.** |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “59-4-8 (DCI format 1\_1 to indicate separate SRS CL-PC)”. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | FFS | 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 |
| Nokia [2] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-1a | 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 [3] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  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 | |
| MediaTek Inc. [4] |  |
| CATT [5] | * The prerequisite feature group for 59-4-7b, 59-4-9a and 59-4-9b should be FG for two SRS closed-loop power control adjustment states separate from PUSCH (i.e., FG 59-4-3).   **Proposal 16: Adopt the following changes marked in red for FG 59-4-7b, 59-4-9a and 59-4-9b:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 TPC for one of two separate SRS closed loop index(es) under joint TCI state mode | ~~FFS~~  59-4-3 | 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 | |
| Huawei/HiSilicon [6] | 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.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 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 | |
| Vivo [7] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-3  ~~FFS~~ | 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 | |
| Xiaomi [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | 59-4-3 | 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 | |
| Samsung [9] |  |
| Ericsson [10] | * Prerequisite feature groups   + 23-1-1 Unified TCI with joint DL/UL TCI update for intra-cell beam management  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~23-1-1 | DCI 1\_1 indicating one of two separate SRS closed loop indexes under joint TCI state mode is not supported |  |  | |
| OPPO [11] |  |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | 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 | |
| Qualcomm Incorporated [14] | For FG59-4-8, the FFS: Further partitioning of this FG based on existing and future agreements (e.g., whether to split based on deployment scenario such asymmetric DL sTRP/UL mTRP and other scenarios) and also whether to have one FG is “DCI format 1\_1 for TPC command indication for a separate SRS CLPC adjustment state” and another is “DCI format 1\_1 for TPC command indication for two separate SRS CLPC adjustment states is not needed considering FG59-4-9a and FG59-4-9b have been agreed to indicate one of two separate SRS closed loop indexes for the case of two separate SRS CLPC adjustment states.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | ~~FFS~~  59-4-3 | 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 |   **Proposal 4-7: Regarding the FFS in FG59-4-8, FG59-4-9a and FG59-4-9b, our view is provided as follows:**   * **The prerequisite FG of FG 59-4-9a and FG 59-4-9b is FG59-4-3.** |
| NTT DOCOMO, INC. [15] | * Pre-requisite FG should be “59-4-8 (DCI format 1\_1 to indicate separate SRS CL-PC)”. Note that this UE may not support DCI format 2\_3 (FG8-6 (TPC-SRS-RNTI)), hence FG23-4-3 (two CL-PC adjustment state) cannot be a prerequisite. |

**Other**

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| ZTE Corporation/Sanechips [3] |  |
| MediaTek Inc. [4] |  |
| CATT [5] |  |
| Huawei/HiSilicon [6] |  |
| Vivo [7] |  |
| Xiaomi [8] |  |
| Samsung [9] |  |
| Ericsson [10] |  |
| OPPO [11] | **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: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange | **Consequence if the feature is not supported by the UE** | **Type** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional | | 59. NR\_MIMO\_Ph5 | 59-4-2a | 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 | |
| Ofinno [12] |  |
| Apple [13] | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 59. NR\_MIMO\_Ph5 | 59-4-10 | Support of Single-DCI based intra-cell Multi-TRP operation with two TA | Support single-DCI based inter-cell Multi-TRP operation with two TA | 59-4-4a | Yes | n/a | Single-DCI based inter-cell Multi-TRP operation with two TA is not supported | Per FS | n/a | n/a | n/a | Candidate value: bitmap {PUSCH TDM repetition Type A, PUSCH TDM repetition Type B, PUCCH TDM repetition, PUSCH SDM, PUSCH SFN, PUCCH SFN}  Note: Single-DCI based Multi-TRP is the operation without the restriction of “the UE is provided two coresetPoolIndex values 0 and 1 for first and second CORESETs, or is not provided coresetPoolIndex value for first CORESETs and is provided coresetPoolIndex value of 1 for second CORESETs”  Note: FG40-2-8, if reported, or supportedNumberTAG” in 38.306 is applied for the maximum number of TAGs | Optional with capability signalling | | 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 FS | n/a | n/a | n/a |  | Optional with capability signalling | |
| Qualcomm Incorporated [14] | 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 4-2: 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. [15] | In RAN1#120bis, the following agreement was made.   |  | | --- | | **Agreement**   * 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* |   However, the agreed UE capability is not captured in UE feature list yet. Hence, we propose 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 following FG40-2-6 in Rel.18. However, Rel.18 two TA is “with coresetPoolIndex” and Rel.19 two TA is “without coresetPoolIndex” and the target scenarios are totally different, we believe it is better to have different FGs between Rel.18 and Rel.19.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |

# Discussion Items during RAN1 #122

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

**General comments**

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

## UE-initiated/event-driven beam management

After review of contributions submitted to RAN1 #122 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 | ~~FFS~~ | 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-1, QCL RS(s) in indicated TCI state(s) and Component-4 are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Support removing FFS and not adding other FGs for the fifth column. * Open to discuss whether to add the note to the thirteenth column (Is there a typo? “Evene-2” seems to be correct.) |
| Huawei, Hisilicon | * Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-2 | UE-initiated/event-driven beam management Mode B | 1. Support of Mode B UE-initiated/event-driven beam report  ~~3~~2. Supported minimum value of X symbols between the last symbol of sending first PUCCH and the first available symbol of transmission occasion of second PUSCH | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | UEI/ED beam report Mode-B is not supported | Per band | n/a | n/a | n/a | Component ~~3~~2 candidate values: ~~[~~{0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512}~~]~~ | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Support |
| Huawei, HiSilicon | * Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-3 | Triggering event determination via detecting ≥ M event instances for at least one new beam within a time window. | ~~Triggering~~ 1. Support of ~~UEI/ED~~ UE initiated/event driven beam report procedure via detecting ≥ M event instance(s) for at least one new beam within a time window, where M>1  2. Support a maximum number of timers to measure in parallel a maximum number of time windows | 59-1-1 ~~FFS for other potential FG(s)~~ | yes | n/a | Triggering event determination via detecting ≥ M event instances within a time window is not supported | Per band | n/a | n/a | n/a | Component 2 candidate values: {1, 2, …, 64} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Support removing FFS and not adding other FGs for the fifth column. * Support to add Component2.   According to the agreement in #120bis meeting, the maximum number of timers simultaneously configured on UE can be limited based on the UE capability.  A new component regarding the maximum number of configurable timers on a UE should be added somewhere, and we prefer to add it to FG 59-1-3. Because timer is highly related to window behavior described in FG59-1-3. We don’t think the separate FG for it is necessary.  **[120b] Agreement**  Regarding triggering event determination for Event 2, on the measurement window for initiating the UE-initiated/event-driven beam reporting procedure, support Option-4.   * Option-4: If an Event-2 instance for a new beam is obtained at the time and the timer for the new beam is not running, UE starts the timer for the new beam, where the expiry time of the timer is equal to the NW-configured length of the time window (T\_window)   + Note: Timer is new beam specific. * Note: T\_window is the agreed time window parameter for measurement. * Introduce separate UE capability to limit the number of timers. There is only 1 timer per new beam.   Above agreement is captured in RAN1 specifications. |
| Huuawei, HiSilicon | * Wording of component 2 is quite ambiguous. Suggest to change it to “maximum number of concurrently running timers”. Other changes OK. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-4 | UE-initiated/event-driven beam management for Event-1 based measurement and report for Mode A | 1. Support of Event-1 based measurement and report for Mode A that L1-RSRP of the current beam becomes worse than a configured threshold based on one event instance | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-1 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Note: the event definition  Event 1: Quality of the current beam is worse than a certain threshold  Note: Regarding Event-1, QCL RS(s) in indicated TCI state(s) are also counted in FG 16-1g, and 16-1g-1 | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Open to discuss whether to add the note to the thirteenth column. |
| Huawei, HiSuilicon | * OK |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-5 | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode A | 1. Support of Event-7 based measurement and report for Mode A that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  2~~3~~. Support of the RS derived from the activated TCI state with the Q-th best quality measurement by using QCL RS in the activated TCI state with the Q-th best quality and the corresponding QCL SSB for the activated TCI state with the Q-th best quality for Scheme-1 and Scheme-2, respectively | 59-1-1 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode A | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q: bitmap of size 8, the n-th bit signals support for Q=n, n = 1,2,…,8, zero means no support, 1 means support  Note: The UE does not expect that the configured Q is greater than the number of the activated DL/joint TCI state(s)  Note: Regarding Event-7, the number of QCL RS(s) in activated TCI state(s) are also counted in FG 16-1g, and 16-1g-1  Note: For Component 2, an SSB can be associated with the serving cell PCI or a PCI other than the serving cell PCI | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Support the revision on the fourth column. * Open to discuss whether to add the note to the thirteenth column. |
| Huawei, HiSilicon | * OK |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-7 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI ~~for Event-2~~ | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI ~~for Event-2~~ | ~~FFS~~ 59-1-1, 59-1-3 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported ~~for Event-2~~ | Per Band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Support to remove “for Event 2.”   This feature should be applied for all configured Event types like FG59-1-2, FG59-1-3. We don’t think that the separate FGs for each Event type are necessary.   * Support FG59-1-3 as a prerequisite FG.   According to the previous agreement, 1-bit indication seems to be able to applied only when the time windows and counters are configured. To make this FG workable, FG59-1-3 should be supported as the prerequisite. When FG59-1-3 is added in the prerequisite FG, FG59-1-1 can be not necessary because FG59-1-1 is the prerequisite FG of FG59-1-3. |
| Huawei, Hisilicon | * Event-2 should not be removed. Instead, we suggest to add a new similar FG for event-7. A similar indication is not captured for event-1 nor agreed for event-1:   The “1-bit condition met indication” has been formally agreed for Event-2 but remained an FFS for Event-7 in RAN1 120-bis. However, based on an earlier agreement in RAN1 119 that “The additionally supported events will reuse the same design as event 2 – unless there is consensus to do otherwise”, the “1-bit condition met indication” is included as an optional part of Event-7 report in Clause 5.2.1.5.4.1c of 38.214. Similar to event 2, we find it reasonable to also support “1-bit condition met indication” for event 7 and, therefore, to introduce a new FG for it.  59-1-1 is already a prerequisite for 59-1-3 and don’t need to be mentioned here as a 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 | 59-1-8 | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-7 | Support of 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI for Event-7 | FG 59-1-3  FG 59-1-5 | yes | n/a | 1-bit condition met indication in RSRP report format for each report of CRI/SSBRI is not supported for Event-7 | Per Band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Not support.   We don’t think that the separate FGs for each Event type are necessary. |
| Huawei, HiSiulicon | * Support. We think we do need this FG. Please see our explanation for 59-1-7. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-8 | Inclusion of current beam measurement in UEI/ED beam report | Support of including the current beam L1-RSRP in the UEI/ED beam report | 59-1-1 | yes | n/a | Inclusion of current beam measurement in UEI/ED beam report is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Not support.   There’s no agerrment which intends that Inclusion of current beam measurement in UEI/ED beam report is subject to UE capability. |
| Huawei, Hisilicon | * Not support. Similar resean as DCM |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-1-4a | UE-initiated/event-driven beam management for Event-1 based measurement and report for Mode B | 1. Support of Event-1 based measurement and report that L1-RSRP of the current beam becomes worse than a configured threshold based on one event instance  2. Supported values of X | 59-1-4 | yes | n/a | UE-initiated/event-driven beam management for Event-1 based measurement is not supported for Mode B | Per Band | n/a | n/a | n/a | Component 2 candidate values: different X in symbols can be reported for different SCS  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-1-5a | UE-initiated/event-driven beam management for Event-7 based measurement and report for Mode B | 1. Support of Event-7 that L1-RSRP of at least one new beam becomes a threshold value better than the RS derived from the activated TCI state with the Q-th best quality based on one event instance  2. Maximum number of the configured RS(s) for new beam in the RS resource set  3. Supported values of X | 59-1-5 | yes | n/a | UE-initiated/event-driven beam management for Event-7 based measurement is not supported for Mode B | Per Band | n/a | n/a | n/a | Component 1 candidate values for Q, 8-bit bitmap  Component 2 candidate values: {1, 2, ..., 64}  Component 3 candidate values: different X in symbols can be reported for different SCS  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-1-7 | Measurement resource for UE initiated beam report | Per slot limitations:  1. The max number of SSB/CSI-RS (1Tx) resources (sum of aperiodic/periodic/semi-persistent) across all CCs configured to measure L1-RSRP within a slot for UE initiated beam report  2. The max number of CSI-RS (2Tx) resources (sum of aperiodic/periodic/semi-persistent) across all CCs configured to measure L1-RSRP within a slot for UE initiated beam report  Memory limitations:  3. The max number of CSI-RS resources across all CCs configured for UE initiated beam report  4. The max number of aperiodic CSI-RS resources across all CCs configured for UE initiated beam report  5. The max number of CSI-RS resources in a CSI-RS resource set configured for new beam for UE initiated beam report  Other limitations:  6. Supported density of CSI-RS (CMR) |  | Yes | n/a | UE initiated beam report is not supported | Per band | n/a | n/a | n/a | Component 1: Candidate values {8, 16, 32, 64}  Component 2: Candidate values {0, 4, 8, 16, 32, 64}  Component 3: Candidate values {8, 16, 32, 64, 128}  Component 4: Candidate values {0, 2, 4, 8, 16, 32, 64}  Component 5: Candidate values {2, 4, 8, 16, 32, 64}  Component 6: Candidate values {'1 only', '3 only', '1 and 3'}  Note: The reference slot duration is the shortest slot duration defined for the FR where the reported band belongs  Note: For component 3, 4, 5  the configured CSI-RS resources for both active and inactive BWPs are counted  Note: For components 1, 2, a SSB/CSI-RS resource is counted within the duration of a reference slot in which the corresponding reference signals are transmitted | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-1-8 | Maximum N for UE initiated beam report | Support of UE initiated beam report with maximum N L1-RSRP values |  | Yes | n/a | Maximum N=1 | Per band | n/a | n/a | n/a | Candidate values {1, 2, 4} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-1-9 | Configuration that current beam is always reported for UE initiated beam report | Support RRC to configure that current beam is always reported for UE initiated beam report |  | Yes | n/a | RRC to configure that current beam is always reported for UE initiated beam report is not supported | Per band | n/a | n/a | n/a | Note: The reported current beam, if configured, is not counted in the N reported beams | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-1-10 | Supported measurement RS for UE-initiated/event-driven beam management | Supported measurement RS for UE-initiated/event-driven beam management | 59-1-1 or 59-1-4 or 59-1-5 | yes | n/a |  | Per band | n/a | n/a | n/a | Candidate value: {SSB, CSI-RS and SSB } | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | * Not support. |
| Huawei, Hisilicon | * Not support |

## CSI enhancements for up to 128 ports

After review of contributions submitted to RAN1 #122 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}  b. {64, …, 256}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value ~~{1:8}~~{2,4}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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}  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 value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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. ~~Max # of CSI-RS resource in a resource set~~ 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 4 candidate value {1:8}~~  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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}  Component 3 candidate value {4, 5, 6, 7, 8}  Component 4 candidate value {~~1:8~~2,4}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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}  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 value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1-1e | Enhanced Type-I SP codebook for 128 ports – Scheme-~~b~~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. ~~Max # of CSI-RS resource in a resource set~~ 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, …, ~~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 value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {~~1:8~~2,4}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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}  Component 3 candidate value {2, 4}  Component 4 candidate value {~~1:8~~2,3}  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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. ~~Max # of CSI-RS resource in a resource set~~ 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 4 candidate value {1:8}~~  Component 5 candidate value {Capability 1, Capability 2}  Component 6 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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 value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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 {2,4}  Component 8 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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 value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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}  Component 6 candidate value {Capability 1, Capability 2}  Component 7 candidate value {2,4}  Component 8 candidate value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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 value FFS  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 ~~ceil(P/32)~~  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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 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 value FFS  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  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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 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 value FFS  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  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |
| 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 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 value FFS  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  Note: If CSI report configuration in active BWP of a CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports per CC are used for the CC instead of values reported in FG2-33.  Note: If CSI report configuration in active BWP of any CC is configured with the higher layer parameter codebookType set to 'XXXXXXXX-r19', values reported in this FG for the number of simultaneous NZP-CSI-RS resources and ports across all CCs are used instead of values reported in FG2-33. | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | For 59-2-1-5/5a/5b, the Component 13 and candidate values for Component 13 are not correct. Because for doppler CSI enhancement, the K is the number of CSI-RS resources per resource group of a resource set, not the number of CSI-RS resources for a resource set. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-6 | CSI-RS resource time domain restriction for extended Type-I and Type II codebook ~~enhancement~~ for up to 128 ports | Support of the K CSI-RS resources configured within two slots for Type-I and Type II codebook enhancement for up to 128 ports | ~~FFS~~ One or more of {59-2-1-1, 1a, 1b, 1c, 1d, 1e, 2, 2a, 2b, 3, 3a, 3b, 4, 4a, 5, 5a, or 5b} | yes | n/a | 2-slot resource aggregation is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | For prerequisite, 59-2-1-1, 1c, 2, 3, 4, 5 would be sufficient. |

**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 | ~~FFS~~ One or more of {59-2-1-1, 1a, 1b, 1c, 1d, 1e} | 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 | Comments/Questions/Suggestions |
| NTT DOCOMO | OK |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-8 | SRS Port Grouping | Support of SRS port grouping | ~~FFS~~ 23-8-3 | yes | n/a | SRS Port Grouping is not supported | Per FS | n/a | n/a | n/a | Candidate values: {xT8R, xT6R, both}  Note: If a UE supports this FG, then the UE supports the corresponding antenna switching configurations and port groupings | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | OK |

**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 | 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 |
| NTT DOCOMO | Prefer not to introduce new component. |

**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 | ~~FFS~~ 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 | Comments/Questions/Suggestions |
| NTT DOCOMO | 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 | ~~FFS~~ 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 | Comments/Questions/Suggestions |
| NTT DOCOMO | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-2-3a | Configuration of MR always-reported resources with Rel-15 Type-I SP codebook | Support MR={1,2} for hybrid BF (CRI-based) with Rel-15 Type-I SP codebook | ~~FFS~~ 59-2-2-1 | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-15 Type-I SP codebook | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-2-3b | Configuration of MR always-reported resources with Rel-16 eType-II codebook with R=1 | Support MR={1} for hybrid BF (CRI-based) with Rel-16 eType-II codebook with R=1 | ~~FFS~~ 59-2-2-2 | Yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 with Rel-16 eType-II codebook with R=1 | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | Support |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-3 | CJTC wideband PO report | 1. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC WB PO reporting  2. Supported value of scaling factor X for OCPU calculation  3. Supported slot duration for NTRP P/SP CSI-RS occaions being confined in | 2-35 | yes | n/a | CJTC PO report is not supported | Per band and per BC | n/a | n/a | n/a | Component 1 candidate values: {16, 32}  Component 2 candidate values: {1, 2}  Component 3 candidate values: {1, 2}  Note：OCPU =X.NTRP | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-4 | CJTC subband PO report | 1. Configured maximum resolution (number of steps) for the quantization alphabet for CJTC SB PO reporting  2. Configured minimum subband size in resource blocks for the CJTC subband PO report  3. Supported value of scaling factor X for OCPU calculation  4. Supported slot duration for NTRP P/SP CSI-RS occaions being confined in | 2-35 | yes | n/a | CJTC subband PO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {16, 32}  Component 2 candidate values: {1, 2, 4, 8, 16}  Component 3 candidate values: {1, 2}  Component 4 candidate values: {1, 2}  Note：OCPU =X.NTRP | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-6a | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-C | The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift} | ~~FFS~~ 40-1-1 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-C | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-6b | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-D | 1. The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {average delay} | ~~FFS~~ 40-1-1 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-D | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-6c | New CJT QCL assumptions for PDSCH pre-compensation for Scheme-E | 1.The PDSCH DMRS port(s) are QCLed with the DL-RS associated with the first TCI state with respect to QCL-TypeA and QCLed with the DL-RS in the second TCI state with respect to QCL-TypeA except for {Doppler shift, average delay} | ~~FFS~~ 40-1-1 | yes | n/a | New QCL assumptions for PDSCH pre-compensation is not supported for Scheme-E | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-7 | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering | 1. Support of joint triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | ~~FFS~~ 59-2-3-1 and 40-3-1-1 | yes | n/a | Linkage of CJTC Dd and Rel-18 eType-II CJT with joint triggering is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-7a | Linkage of CJTC Dd and Rel-18 eType-II CJT with separate triggering | Support separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI | ~~FFS~~ 59-2-3-1 and 40-3-1-1 | yes | n/a | Separate triggering for linked CJTC Delay offset reporting and Rel-18 eType-II CJT CSI is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-8 | Separate triggering with configuration of 1-bit indicator per CSI trigger state | Support of 1 bit indicate per trigger state for separate triggering of linked DO reporting and Type II CJT reporting | ~~FFS~~ 59-2-3-7a | yes | n/a | Separate triggering with configuration of 1-bit indicator per CSI trigger state is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-3-10 | Relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT | Support of relaxed timeline for joint triggering of CJTC Dd and Rel-18 eType-II CJT, i.e., Drelax = drelax | ~~FFS~~ 59-2-3-7 | yes | n/a | Relaxed timeline for joint triggering od CJTC Dd and Rel-18 eType-II CJT is not supported, i.e., Drelax = 0 | Per band and per BC | n/a | n/a | n/a | Component candidate values:  15kHz SCS: {2, 4, 8}  30kHz SCS: {4, 8, 14, 28}  60kHz SCS: {8,14, 28}  120kHz SCS: {14,28, 56}  480kHz SCS: {56, 112, 224}  960kHz SCS: {112, 224, 448} | Optional with capability signalling |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | [59-2-2-4] | Configuration of MR always-reported resources for Type-I | Supported maximum number of MR for Type-I | 59-2-2-3a | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 for Type-I | Per band | n/a | n/a | n/a | Component candidate values: MR={1,2} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | [59-2-2-4a] | Configuration of MR always-reported resources for Rel-16 eType-II | For Rel-16 eType-II, MR={1} | 59-2-2-3b | yes | n/a | Configuration of MR always-reported resources is not supported, i.e. MR=0 for Rel-16 eType-II | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | Not support. Duplicated with 59-2-2-3a/3b. |

**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 |
|  |  |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-X | Group-based hard CBSR | Support of group-based hard CBSR |  | yes | n/a | Group-based hard CBSR is not supported | Per band and per BC | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | Not needed. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-2-1-1f | CBSR for Rel-15 Type-I SP (single panel) codebook enhancement for up to 128 ports | Support CBSR for Rel-15 Type-I SP (single panel) codebook enhancement for up to 128 ports |  | Yes | n/a | CBSR for Rel-15 Type-I SP (single panel) codebook enhancement for up to 128 ports is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-1g | CSI-RS port mapping for Type-I and Type II codebook enhancement for up to 128 ports | Supported CSI-RS port mapping schemes for Type-I and Type II codebook enhancement for up to 128 ports |  | Yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Candidate value {Mapping method 1, Mapping method 2} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-1a | CJTC Dd report processing | 1. Maximum number of configured TRS resource sets for delay offset report  2. Maximum number of configured TRS resource sets for delay offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  3. Maximum number of simultaneously active CSI-RS resources for delay offset report per CC  4. Maximum number of simultaneously active CSI-RS resources for delay offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  5. Value of X for CPU occupation (OCPU=X⋅NTRP) | 59-2-3-1 | yes | n/a |  | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-1b | Maximum number of TRS resource sets in a report configuration for delay offset report | Maximum number of TRS resource sets in a report configuration for delay offset report | 59-2-3-1 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {2, 3, 4} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-1c | Maximum number of delay offset report settings per BWP | Maximum number of delay offset report settings (*CSI-ReportConfig)* configured with *resourcesForChannelMeasurement* linked to a same BWP ID | 59-2-3-1 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {1, 2, 3, 4} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-2a | CJTC FO report processing | 1. Maximum number of configured TRS resource sets for frequency offset report  2. Maximum number of configured TRS resource sets for frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  3. Maximum number of simultaneously active CSI-RS resources for frequency offset report per CC  4. Maximum number of simultaneously active CSI-RS resources for frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  5. Value of X for CPU occupation (OCPU=X⋅NTRP) | 59-2-3-2 | yes | n/a | CJTC FO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} |  |
| 59. NR\_MIMO\_Ph5 | 59-2-3-2b | Maximum number of TRS resource sets in a report configuration for frequency offset report | Maximum number of TRS resource sets in a report configuration for frequency offset report | 59-2-3-2 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {2, 3, 4} |  |
| 59. NR\_MIMO\_Ph5 | 59-2-3-2c | Maximum number of frequency offset report settings per BWP | Maximum number of frequency offset report settings (*CSI-ReportConfig)* configured with *resourcesForChannelMeasurement* linked to a same BWP ID | 59-2-3-2 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {1, 2, 3, 4} |  |
| 59. NR\_MIMO\_Ph5 | 59-2-3-3a | CJTC wideband PO report processing | 1. Maximum number of configured CSI-RS resources for phase offset report  2. Maximum number of configured CSI-RS resources for phase offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  3. Maximum number of simultaneously active CSI-RS resources for phase offset report per CC  4. Maximum number of simultaneously active CSI-RS resources for phase offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  5. Value of X for CPU occupation (OCPU=X⋅NTRP) | 59-2-3-3 | yes | n/a | CJTC PO report is not supported | Per band and Per BC | n/a | n/a | n/a | Component 1 candidate values: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-3b | Maximum number of CSI-RS resources in a report configuration for phase offset report | Maximum number of CSI-RS resources in a report configuration for phase offset report | 59-2-3-3 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {2, 3, 4} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-3c | Maximum number of phase offset report settings per BWP | Maximum number of phase offset report settings (*CSI-ReportConfig)* configured with *resourcesForChannelMeasurement* linked to a same BWP ID | 59-2-3-3 | Yes | n/a |  | Per FS | n/a | n/a | n/a | Candidate values: {1, 2, 3, 4} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-5a | CJTC Dd+FO report processing | 1. Maximum number of configured TRS resource sets for joint delay and frequency offset report  2. Maximum number of configured TRS resource sets for joint delay and frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  4. Maximum number of simultaneously active CSI-RS resources for joint delay and frequency offset report per CC  4. Maximum number of simultaneously active CSI-RS resources for joint delay and frequency offset report across all CCs in a band when reported per band, and across all CCs in a band combination when reported per BC  5. Value of X for CPU occupation (OCPU=2X⋅NTRP) | 59-2-3-5 | 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: {2, 4, 6, 8, 10, 12}  Component 2 candidate values: {2, 4, 6, 8, 12, … 64}  Component 3 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32}  Component 4 candidate values: {2, 4, 6, 8, 12, 16, 20, 24, 28, 32, …, 64}  Component 5 candidate values: {1, 2} | Optional with capability signalling |
| 59. NR\_MIMO\_Ph5 | 59-2-3-9 | RRC configuration of 1 SRS port of antenna switching associated with phase offset report | Support of RRC configuration of 1 SRS port of antenna switching associate with phased offset report |  | Yes | n/a | RRC configuration of 1 SRS port of antenna switching associated with phase offset report is not supported | Per band and Per BC | n/a | n/a | n/a |  | Optional with capability signalling |

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

**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 |
| NTT DOCOMO | Open to discuss. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR MIMO phase 5 | 59-2-2-XX | CSI-RS resource-specific RI restriction | Support of CSI-RS resource-specific RI restriction for Rel-19 CRI-based report | 59-2-2-1 or 59-2-2-2 | YES | N/A | RI restrictions need to be configured same for all CSI-RS resources in the resource set | Per-band and per-BC | N/A | N/A | N/A |  | Optional with capability signaling |
| 59. NR MIMO phase 5 | 59-2-2-XX | CSI-RS resource-specific triggering offset | Support of CSI-RS resource-specific triggering offset for aperiodic CSI-RS | 59-2-2-1 or 59-2-2-2 | YES | N/A | Aperiodic triggering offsets for all CSI-RS resources in the resource set need to be same | Per-band and per-BC | N/A | N/A | N/A |  | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT DOCOMO | Not needed |

## 3-antenna-port codebook-based transmissions

After review of contributions submitted to RAN1 #122 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 set (SRS set use is configured as for non-codebook transmission)  3. Maximum number of simultaneous transmitted SRS resources at one symbol | ~~FFS~~ 2-15 | 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 |
| NTT Docomo | In our understanding, no pre-requisite is needed. 2-15 has same components as this FG but with different candidate values (i.e., the candidate value is up to 4 in 2-15). This FG can be signaled independently from 2-15. |
| Ericsson | Do not support. Similar to the Rel-18 feature for 8Tx non-codebook-based PUSCH (FG 40-7-2), which does not rely on any legacy UE capability FG, the Rel-19 introduction of 3Tx non-codebook based transmission also does not require any prerequisite. Alternatively, we can support FG 59-3-1 depending on **FG 2-12**, which defines “Basic PUSCH transmission” (similar to the legacy non-codebook-based PUSCH in Rel-15 that depends on FG 2-12) |

**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  4. Codebook based PUSCH transmission with port 1003 disabled when 4 port SRS resources with port 1003 disabled are configured to the UE | ~~FFS~~ 2-14 | 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 | Comments/Questions/Suggestions |
| NTT Docomo | In our understanding, no pre-requisite is needed. 2-14 has same components 1/2 as this FG but with different candidate values (i.e., the candidate value of component 1 is up to 4 in 2-14) . This FG can be signaled independently from 2-14. |
| Ericsson | Do not support. Similar to the Rel-18 feature for 8Tx codebook-based PUSCH (FG 40-7-1), which does not rely on any legacy UE capability FG, the Rel-19 introduction of 3Tx codebook based transmission also does not require any prerequisite. Alternatively, we can support FG 59-3-2 depending on **FG 2-12**, which specifies “Basic PUSCH transmission.” Note that the legacy codebook based PUSCH capability (FG 2-14) depends on FG 2-13 (PUSCH codebook coherence subset), which in turn depends on FG 2-12. Since no codebook coherence subset is defined for 3Tx PUSCH, the 3Tx codebook based PUSCH can directly depend on FG 2-12. |

**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. Support of 3T6R antenna switching configuration(s) as an allowing downgrading configuration of 4T8R]~~ | ~~FFS~~ 2-53 | 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| NTT Docomo | Support |
| Ericsson | Support the note based on the majority view. While our preference is to define an explicit set of associated antenna switching capabilities {t1r1, t2r2, t1r2, t3r3, t2r4, t1r4, t2r6, t1r6, t3r6} within Component 1, given the majority view favoring the 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,”* we support the proposal.  We also support having **FG 2-53** as a prerequisite for FG 59-3-3, since FG 2-53 encapsulates the basic SRS capabilities required for SRS transmission during antenna switching. This aligns with the Rel-18 antenna switching capability for 8T8R (FG 40-5-4), which also specifies FG 2-53 as a prerequisite. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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~~ 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 | Comments/Questions/Suggestions |
| NTT Docomo | Support |
| Ericsson | Support. **FG 2-53** (SRS resources) can serve as a prerequisite for FG 59-3-3a, as it encapsulates the basic SRS capabilities required for SRS transmission during antenna switching. This is also consistent with the Rel-18 antenna switching capability for 8T8R (FG 40-5-4), which specifies FG 2-53 as a prerequisite**.** |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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~~ 23-3-1 | 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 | Comments/Questions/Suggestions |
| NTT Docomo | 23-3-1 (R17 mTRP PUSCH) does not need to be the pre-requisite.  The pre-requisite should be 59-3-2 (3Tx sTRP codebook PUSCH). |
| Ericsson | Do not support. **FG 59-3-2** should be the prerequisite for FG 59-3-4, as a UE supporting M-TRP PUSCH repetition (type A) with 3-antenna-port codebook based transmission relies on the components of 3Tx codebook based single-TRP transmission. This approach is consistent with legacy behavior, where FG 23-3-1 (Multi-TRP PUSCH repetition (type A) – codebook-based) specifies FG 2-14 (Codebook-based PUSCH MIMO transmission) as its sole prerequisite. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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~~ 23-3-1-2 | 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 | Comments/Questions/Suggestions |
| NTT Docomo | 23-3-1-2 (R17 mTRP PUSCH) does not need to be the pre-requisite.  The pre-requisite should be 59-3-1 (3Tx sTRP non-codebook PUSCH). |
| Ericsson | Do not support. **FG 59-3-1** (non-codebook-based PUSCH transmission with 3Tx for single TRP) should be the prerequisite for FG 59-3-4a, as a UE supporting 3Tx M-TRP non-codebook based PUSCH relies on the components of 3Tx non-codebook-based single-TRP transmission. This aligns with legacy behavior, where FG 23-3-1-2 (Multi-TRP PUSCH repetition (type A), non-codebook-based) specifies FG 2-15 (non-codebook-based PUSCH MIMO transmission) as its sole prerequisite. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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~~ 23-3-1-1 | 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 | Comments/Questions/Suggestions |
| NTT Docomo | 23-3-1-1(R17 mTRP PUSCH) does not need to be the pre-requisite.  The pre-requisite should be 59-3-2 (3Tx sTRP codebook PUSCH). |
| Ericsson | Do not support. **FG 59-3-2** (codebook based PUSCH transmission with 3Tx for single TRP) and **FG 11-5** (PUSCH repetition Type B) should be prerequisites for FG 59-3-5, as a UE supporting M-TRP PUSCH repetition (type B) with 3-antenna-port codebook based transmission depends on the components of 3Tx codebook based single-TRP transmission and capability for PUSCH repetition Type B. This is consistent with legacy behavior, where FG 23-3-1-1 (Multi-TRP PUSCH repetition (type B), codebook based) has FG 2-14 (codebook based PUSCH MIMO transmission) and FG 11-5 as prerequisites. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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~~ 23-3-1-3 | 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 | Comments/Questions/Suggestions |
| NTT Docomo | 23-3-1-3 (R17 mTRP PUSCH) does not need to be the pre-requisite.  The pre-requisite should be 59-3-2 (3Tx sTRP non-codebook PUSCH). |
| Ericsson | Do not support. **FG 59-3-1** (non-codebook-based PUSCH transmission with 3Tx for single TRP) and **FG 11-5** (PUSCH repetition Type B) should be prerequisites for FG 59-3-5a, as a UE supporting M-TRP PUSCH repetition (type B) with 3-antenna-port non-codebook based transmission relies on the components of 3Tx non-codebook based single-TRP transmission and capability for PUSCH repetition Type B. This aligns with legacy behavior, where FG 23-3-1-3 (Multi-TRP PUSCH repetition (type B), non-codebook-based) has FG 2-15 (non-codebook-based PUSCH MIMO transmission) and FG 11-5 as prerequisites. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | Comments/Questions/Suggestions |
| NTT Docomo | Support |
| Ericsson | Support. At least one of **FG 59-3-1 or FG 59-3-2** (3Tx non-codebook or codebook based PUSCH for single TRP) should be a prerequisite for FG 59-3-6, since PTRS port(s) are only configured when the UE supports 3Tx non-codebook or codebook based transmission. |

## Asymmetric DL sTRP/UL mTRP scenarios

After review of contributions submitted to RAN1 #122 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 | 59-4-3 | Two SRS closed-loop power control adjustment states separatefrom PUSCH | Support of two separate SRS closed loop indices separate from PUSCH | ~~FFS~~ | 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 |
| QC | Based on the following agreement, support unified TCI state (23-1-1) is a prerequisite of this FG since closedLoopIndex-r17 for SRS in the TCI state indicates one of the SRS CLPC adjustment states.  **Agreement**  For a UE configured with two SRS CLPC adjustment states, support **Alt2** for indicating one of the SRS CLPC adjustment states to SRS:   * Alt2: When the parameter srs-PowerControlAdjustmentStates is set to 'separateClosedLoop', closedLoopIndex-r17 for SRS in the TCI state indicates one of the SRS CLPC adjustment states   + The candidate value of i0 and i1 in *closedLoopIndex-r17* for SRS refers to the first and the second CLPC adjustment state separate from PUSCH, respectively |
| DOCOMO | We think pre-requisite FG should be “8-6 (TPC-SRS-RNTI)”, which indicates the support of one closed loop adjustment state for SRS.  However, considering the companies’ views are divergent, we are fine with no pre-requisite. |

**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 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 | ~~FFS~~ 59-4-4a or 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 | Comments/Questions/Suggestions |
| QC | The prerequisite FG is only 59-4-4b.  FG 59-4-4d is for inter-cell scenario, while 59-4-4a are two TAs for intra-cell BM scenario, we don’t see why FG59-4-4a should be the prerequisite. |
| Docomo | FG59-4-4d is for inter-cell, hence pre-requisite FG should be FG59-4-4b (inter-cell) only. We suggest to remove FG59-4-4a. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-5 | Overlapping UL transmission reduction | Support of reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions when the UE is with two TA enhancement | ~~FFS~~ 59-4-4a or 59-4-4b | yes | n/a | Reducing the overlapping duration of the later of the two time-domain overlapping UL transmissions is not supported | Per band | n/a | n/a | n/a | Note: If UE does not support this feature, UE does not expect the two UL transmissions to overlap | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| QC | This can be discussed after discussing FG59-4-10 below, this is because the prerequisite of FG59-4-5 depends on whether FG59-4-10 is supported. If FG 59-4-10 is supported, it is also the prerequisite FG of FG 59-4-5. |
| Docomo | OK |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR MIMO Phase 5 | 59-4-6 | MAC-CE update of PL offset value(s) | Support of MAC-CE update of the configured PL offset value(s) | ~~FFS~~ 59-4-1a or 59-4-1b | yes | n/a | MAC-CE update of the configured PL offset value(s) is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| QC | OK. |
| Docomo | Pre-requisite FG should be “59-4-1a, 59-4-1b, 59-4-2a, or 59-4-2b” because this FG is only applicable for a UE supports PL-offset.  Considering pre-requisite FG of 59-4-2a and 59-4-2b, it is possible UE supports FG of 59-4-2a and 59-4-2b but not support FG 59-4-1a and 59-4-1b. Hence, we need to mention all of 4 FGs. |

**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. | ~~FFS~~ 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 | Comments/Questions/Suggestions |
| QC | OK. |
| Docomo | Support. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-8 | DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | Support of DCI format 1\_1 to indicate TPC command for SRS associated with a separate SRS CLPC adjustment state | ~~FFS~~ 59-4-3 | yes | n/a | DCI 1\_1 indicating TPC command for SRS associated with a separate SRS CLPC adjustment state is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| QC | Not support. FG 59-4-8 can be supported even if single SRS CLPCadjustment state is configured. |
| Docomo | OK, if FG59-4-3 is not limited to DCI 2\_3. |

**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 two separate SRS closed loop index(es) under separate DL/UL TCI state mode | ~~FFS~~ 59-4-3 | 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| QC | OK. |
| Docomo | Pre-requisite FG should be “59-4-8 (DCI format 1\_1 to indicate separate SRS CL-PC)”. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | ~~FFS~~ 59-4-3 | 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 |
| QC | OK. |
| Docomo | Pre-requisite FG should be “59-4-8 (DCI format 1\_1 to indicate separate SRS CL-PC)”. |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 59. NR\_MIMO\_Ph5 | 59-4-10 | Support of Single-DCI based intra-cell Multi-TRP operation with two TA | Support single-DCI based inter-cell Multi-TRP operation with two TA | 59-4-4a | Yes | n/a | Single-DCI based inter-cell Multi-TRP operation with two TA is not supported | Per FS | n/a | n/a | n/a | Candidate value: bitmap {PUSCH TDM repetition Type A, PUSCH TDM repetition Type B, PUCCH TDM repetition, PUSCH SDM, PUSCH SFN, PUCCH SFN}  Note: Single-DCI based Multi-TRP is the operation without the restriction of “the UE is provided two coresetPoolIndex values 0 and 1 for first and second CORESETs, or is not provided coresetPoolIndex value for first CORESETs and is provided coresetPoolIndex value of 1 for second CORESETs”  Note: FG40-2-8, if reported, or supportedNumberTAG” in 38.306 is applied for the maximum number of TAGs | Optional with capability signalling |
| 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 FS | n/a | n/a | n/a |  | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| QC | For FG59-4-10, we support this FG except the prerequisite FG column. We don’t think FG 59-4-4a is prerequisite FG for FG 59-4-10. And FG59-4-4a and FG59-4-10 are separate FGs, where FG59-4-4a is for single TRP while FG59-4-10 is for sDCI mTRP.  For FG59-4-11, we support this FG except the Type column. Consideirng FG 59-4-1a “ PL offset for PUCCH/PUSCH/SRS power control for joint DL/UL TCI state(s)” is per band, the FG 59-4-11 can also be per band. |
| Docomo | FG-59-4-10 is not needed because it is covered by FG59-4-4b.  OK to introduce FG59-4-11. |

**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 |
| QC | Support. Basically, this is same FG as FG 59-4-10. We think it make sense to include the note in FG 59-4-10 in the above proposal here. |
| Docomo | FG-59-4-4c is not needed because it is covered by FG59-4-4a. |

**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 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
| QC | Not support. In Rel.18, the following UE capability was introduced. Although the following UE capability was introduced in Rel.18 two TAs, while it is a separate UE capability without any prerequisite FG. Considering this, we think the following UE capability is sufficient and no need to introduce a same new UE capability in Rel.19.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 |  | yes | N/A | Rx timing difference larger than CP is not supported | Per FSPC | n/a | n/a | n/a |  | Optional with capability signaling | |
| Docomo | Support. This capability is based on the following agreement.  **Agreement (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* |

# Conclusion

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

# References

1. R1-2504673, Updated RAN1 UE features list for Rel-19 NR after RAN1 #122, Moderators (AT&T, NTT DOCOMO, INC.)
2. R1-2505190, NR MIMO Phase 5 UE features, Nokia
3. R1-2505272, Discussion on UE features for NR MIMO Phase 5, ZTE Corporation/Sanechips
4. R1-2505287, UE features for NR MIMO Phase 5, MediaTek Inc.
5. R1-2505335, Remaining issues on UE features for NR MIMO Phase 5, CATT
6. R1-2505344, UE features for NR MIMO Phase 5, Huawei/HiSilicon
7. R1-2505395, UE features for NR MIMO Phase 5, vivo
8. R1-2505444, Discussion on UE features for NR MIMO Phase 5, Xiaomi
9. R1-2505561, UE features for NR MIMO Phase 5, Samsung
10. R1-2505610, UE features for NR MIMO Phase 5, Ericsson
11. R1-2505739, UE features for NR MIMO Phase 5, OPPO
12. R1-2505668, Views on UE features for NR MIMO Phase 5, Ofinno
13. R1-2505894, Views on UE features for NR MIMO Phase 5, Apple
14. R1-2506196, UE features for NR MIMO phase 5, Qualcomm Incorporated
15. R1-2506285, Discussion on MIMO UE feature, NTT DOCOMO, INC.