**3GPP TSG RAN WG1 #107bis-e R1-200xxxx**

**e-Meeting, January 17th – 25th, 2022**

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

**Title: Session Notes of AI 8.15.1**

**Agenda Item:** **8.15.1**

**Document for:** **Endorsement**

1.

#### 8.15.1 UE features for further enhancements on NR-MIMO

[107bis-e-R17-UE-features-MIMO-01] Email discussion UE features for further enhancements on NR-MIMO – Ralf (AT&T)

* 1st check point: January 20
* Final check point: January 25

**Agreement: Adopt the following changes highlighted in green, while keeping the yellow highlighting as shown**

* The following are the components of the feature “joint TCI for intra-cell operation”
1. Joint DL/UL TCI update with their components: (configuration mechanism, ~~[~~QCL rules,~~]~~ applicable source and target signals, ~~MAC-CE -based TCI]~~ ~~activation~~)
2. Common multi-CC TCI update and activation ~~(involving RRC common TCI state pool)~~
3. For PUCCH, PUSCH, and SRS, association between TCI state and UL PC settings except for PL RS ~~[for PUCCH, PUSCH, and SRS]~~
4. Beam misalignment between the DL source RS in the TCI state to provide spatial relation indication and the PL-RS
5. TCI state indication [mode]: update and activation [in case of updates]a) MAC CE based TCI state indication [for one active TCI state]
b) ~~[~~MAC-CE+DCI-based TCI state indication (~~including TCI state activation,~~ use of DCI formats 1\_1/1\_2 with ~~and without~~ DL assignment)~~]~~
c) MAC-CE+DCI-based TCI state indication (use of DCI formats 1\_1/1\_2 without DL assignment)
6. [TCI states pool for configured reference BWP/CC shared by a set of BWP/CC] FFS: (involving RRC common TCI state pool)
7. [Maximum number of CCs configured with BFR]
8. [R17 mechanism reusing R15/16 signalling to indicate R17 TCI for individual DL channel/RS that cannot share the same unified TCI as UE-dedicated PDCCH/PDSCH]
9. [Configuration of both R17 TCI and R15/16 TCI and spatial relation]
10. The maximum number of configured joint TCI state pools across all BWPs and all CCs in a band [in a band combination]
11. ~~[~~The maximum number of configured joint TCI states across all BWPs and all CCs in a band~~]~~ [in a band combination]
12. ~~[~~The maximum number of configured joint TCI states per CC ~~[~~in a band~~]]~~ [in a band combination]
13. ~~[~~The maximum number of MAC-CE activated joint TCI states ~~[per BWP per CC/~~across ~~all BWPs and~~ all CCs in a band~~]]~~ in a band combination
a) The maximum number of MAC-CE activated joint TCI states per CC in a band in a band combination
14. [Whether a particular DL RS that is a valid target DL RS of a Rel-15/16 TCI state based on the Rel-15/16 QCL rules can be configured as a target DL RS of Rel-17 DL TCI (hence the Rel-17 DL TCI state pool)]
15. [The minimum beam application time between PUCCH of ACK and the first slot in Y symbols per SCS]
16. [The minimum time gap between the beam indication PDCCH and first slot where beam is applied]
* This list gives no guidance as to how to group these components into FGs. They may be mapped to one or more FGs and one or more of these FGs may be agreed as basic. Specifically, different FGs can be grouped together through notes “a UE supporting this FG must also support FG 23-x-y”. This allows to create “basic” FGs while allowing, e.g., different types for different components/candidate values.

**Agreement: Adopt the following changes highlighted in green, while keeping the yellow highlighting as shown**

* The following are the components of the feature “joint TCI for intra-cell operation”
1. Joint DL/UL TCI update with their components: (configuration mechanism, ~~[~~QCL rules,~~]~~ applicable source and target signals, ~~MAC-CE -based TCI]~~ ~~activation~~)
2. Common multi-CC TCI update and activation ~~(involving RRC common TCI state pool)~~
3. For PUCCH, PUSCH, and SRS, association between TCI state and UL PC settings except for PL RS ~~[for PUCCH, PUSCH, and SRS]~~
4. Beam misalignment between the DL source RS in the TCI state to provide spatial relation indication and the PL-RS
5. TCI state indication [mode]: update and activation [in case of updates]a) MAC CE based TCI state indication [for one active TCI state]
b) ~~[~~MAC-CE+DCI-based TCI state indication (~~including TCI state activation,~~ use of DCI formats 1\_1/1\_2 with ~~and without~~ DL assignment)~~]~~
c) MAC-CE+DCI-based TCI state indication (use of DCI formats 1\_1/1\_2 without DL assignment)
6. ~~[TCI states pool for configured~~ Reference BWP/CC configured with reference TCI state pool shared by a set of BWP/CC~~]~~Note: agree component, final wording may change (e.g., when this is merged with other components/FGs)
7. ~~[~~Maximum number of CCs configured with BFR~~]~~
FFS whether this is a component or just a note in the FG to reuse R16 signaling
8. [R17 mechanism reusing R15/16 signalling to indicate R17 TCI for individual DL channel/RS that cannot share the same unified TCI as UE-dedicated PDCCH/PDSCH]
9. ~~[Configuration of both R17 TCI and R15/16 TCI and spatial relation]~~
10. The maximum number of configured joint TCI state pools across all BWPs and all CCs in a band [in a band combination]
FFS: Whether to make component 6 a prerequisite or merge with 6
11. [The maximum number of configured joint TCI states across all BWPs and all CCs in a band] [in a band combination]
12. ~~[~~The maximum number of configured joint TCI states [per BWP per CC] [in a band]~~]~~ [in a band combination]
13. ~~[~~The maximum number of MAC-CE activated joint TCI states ~~[per BWP per CC/~~across ~~all BWPs and~~ all CCs [in a band]~~]]~~ [in a band combination]
a) The maximum number of MAC-CE activated joint TCI states per CC [in a band] [in a band combination]
14. ~~[Whether a particular DL RS that is a valid target DL RS of a Rel-15/16 TCI state based on the Rel-15/16 QCL rules can be configured as a target DL RS of Rel-17 DL TCI (hence the Rel-17 DL TCI state pool)]~~
15. [The minimum beam application time between PUCCH of ACK and the first slot in Y symbols per SCS]
16. [The minimum time gap between the beam indication PDCCH and first slot where beam is applied]
* This list gives no guidance as to how to group these components into FGs. They may be mapped to one or more FGs and one or more of these FGs may be agreed as basic. Specifically, different FGs can be grouped together through notes “a UE supporting this FG must also support FG 23-x-y”. This allows to create “basic” FGs while allowing, e.g., different types for different components/candidate values.

**Proposal: Replace the existing FG 23-1-1 with the following update (keeping the yellow highlighting as shown):**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 23. NR\_FeMIMO | 23-1-1 | Unified TCI for [intra- and inter-cell] beam management |  |  |  |  |  |  |  |  |  |  | Optional with capability signalling |

[R1-2200031](../../Docs/R1-2200031.zip) Rel-17 UE features for further NR MIMO enhancements Huawei, HiSilicon

[R1-2200057](../../Docs/R1-2200057.zip) UE features for feMIMO ZTE

[R1-2200098](../../Docs/R1-2200098.zip) Discussion on Rel-17 MIMO UE features vivo

[R1-2200136](../../Docs/R1-2200136.zip) UE features for Rel-17 FeMIMO CATT

[R1-2200216](../../Docs/R1-2200216.zip) UE features for further enhancements on NR-MIMO Samsung

[R1-2200246](../../Docs/R1-2200246.zip) Discussion on Rel.17 FeMIMO UE features NTT DOCOMO, INC.

[R1-2200285](../../Docs/R1-2200285.zip) Discussion on UE features for FeMIMO Spreadtrum Communications

[R1-2200311](../../Docs/R1-2200311.zip) Discussion on FeMIMO UE features Qualcomm Incorporated

[R1-2200341](../../Docs/R1-2200341.zip) UE features for further enhancements on NR-MIMO OPPO

[R1-2200389](../../Docs/R1-2200389.zip) UE Features for FeMIMO Intel Corporation

[R1-2200430](../../Docs/R1-2200430.zip) Views on Rel-17 FeMIMO UE features Apple

[R1-2200445](../../Docs/R1-2200445.zip) MIMO Rel-17 UE features FUTUREWEI

[R1-2200454](../../Docs/R1-2200454.zip) Discussion on UE features for FeMIMO xiaomi

[R1-2200493](../../Docs/R1-2200493.zip) Discussion on Rel-17 UE feature for NR FeMIMO LG Electronics

[R1-2200535](../../Docs/R1-2200535.zip) Discussion on UE features for FeMIMO Lenovo, Motorola Mobility

[R1-2200536](../../Docs/R1-2200536.zip) Discussion on UE features for FeMIMO Ericsson

[R1-2200544](../../Docs/R1-2200544.zip) UE Features for further enhancements on NR MIMO MediaTek Inc.

[R1-2200599](../../Docs/R1-2200599.zip) Discussion on FeMIMO UE features CMCC

[R1-2200622](../../Docs/R1-2200622.zip) On UE features for further enhancements on NR-MIMO Nokia, Nokia Shanghai Bell