**3GPP TSG RAN WG1 #108-e R1-2nnnnn**

**e-Meeting, February 21st – March 3rd, 2022**

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

**Title: Session Notes of AI 8.16.1**

**Agenda Item:** **8.16.1**

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

1.

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

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

* 1st check point: February 25
* Final check point: March 3

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  23. NR\_FeMIMO | 23-1-1 | Unified TCI ~~[~~with joint DL/UL TCI update~~]~~ for intra- [and inter-cell] beam management | 1. Joint DL/UL TCI update with their components: (configuration mechanism, QCL rules, applicable source and target signals)

~~FFS: whether to include the following components 2-14 into this FG or one or more separate FGs~~~~FFS: Whether basic FGs are defined, and if so, which components are basic FGs, i.e., a UE that supports FG 23-1-1 must also support said basic FGs~~~~FFS: basic FGs for UEs supporting CA~~~~FFS: separate FGs for inter/intra/joint/separate~~ 1. Common multi-CC TCI update and activation **New FG for UE supporting CA**
2. For PUCCH, PUSCH, and SRS, association between TCI state and UL PC settings except for PL RS **Basic or New FG for power control in unified TCI state framework**
3. The maximum number of configured joint TCI states [per BWP per CC] [in a band] [in a band combination]**Basic**
4. The maximum number of MAC-CE activated joint TCI states across 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]**Basic**
5. [The minimum beam application time between PUCCH of ACK and the first slot in Y symbols per SCS]**Basic or new FG [23-1-1a]**
6. Beam misalignment between the DL source RS in the TCI state to provide spatial relation indication and the PL-RS **New FG for power control in unified TCI state framework or new FG**
7. TCI state indication [mode]: update and activation [in case of updates]a) MAC CE based TCI state indication [for one active TCI state]**Basic** b) MAC-CE+DCI-based TCI state indication (use of DCI formats 1\_1/1\_2 with DL assignment)c) MAC-CE+DCI-based TCI state indication (use of DCI formats 1\_1/1\_2 without DL assignment)**Basic or new FG [23-1-1a] or new FG**
8. Reference BWP/CC configured with reference TCI state pool shared by a set of BWP/CCNote: agree component, final wording may change (e.g., when this is merged with other components/FGs)**New FG for UE supporting CA**
9. Maximum number of CCs configured with BFR**Basic or new FG [FG 23-1-1a] or new FG**FFS whether this is a component or just a note in the FG to reuse R16 signaling
10. Support of indication/configuration of R17 TCI states for aperiodic CSI-RS, PDCCH, PDSCH, and SRS reusing the Rel-15/16 signaling/configuration design(s)Note: This has no impact on detail signaling design for SRS TCI indication**New FG [FG 23-1-1a] or new FG**
11. The maximum number of configured joint TCI state pools across all BWPs and all CCs in a band [in a band combination]**New FG for UE supporting CA**FFS: Whether to make component 9 a prerequisite or merge with 9
12. [Alt. 1: ~~[~~The maximum number of PDSCH-Configs containing TCI states that can referred to from a PDSCH-Config without TCI statesAlt. 2: Support PDSCH-Config which contains a reference to another CC/BWP, in which the PDSCH-Config contains the TCI state list]**New FG for UE supporting CA**

~~[14. The minimum time gap between the beam indication PDCCH and first slot where beam is applied]~~ |  |  |  |  |  |  |  |  |  | Optional with capability signalling |
|  23. NR\_FeMIMO | 23-1-1b | Unified TCI with separate DL/UL TCI update for intra- [and inter-] cell beam management | 1. Separate DL/UL TCI update with their components: (configuration mechanism, QCL rules, applicable source and target signals, beam misalignment)2. The maximum number of configured DL TCI states per BWP per CC3. The maximum number of configured UL TCI states per BWP per CC4. The maximum number of RRC configured UL TCI states across all CCs5. The maximum number of MAC-CE activated DL TCI states for all PDCCH/PDSCH receptions across all CCs in a band6. The maximum number of MAC-CE activated UL TCI states for all PUSCH/PUCCH receptions across all CCs in a band7. The maximum number of MAC-CE activated DL TCI states for all PDCCH/PDSCH receptions per CC8. The maximum number of MAC-CE activated UL TCI states for all PUSCH/PUCCH receptions per CC | 23-1-1 |  |  |  |  |  |  |  |  | Optional with capability signalling |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  23. NR\_FeMIMO | 23-1-2 | Inter-cell beam measurement and reporting [(for inter-cell BM [and mTRP])] | 1. Support of L1-RSRP measurement and reporting on SSB(s) with PCI(s) different from serving cell PCIFFS: whether to include the following components 2-13 into this FG or one or more separate FGsFFS: Whether basic FGs are defined, and if so, which components are basic FGs, i.e., a UE that supports FG 23-1-2 must also support said basic FGs[==============================]2. Support of up to K[=4] SSBRI-RSRP [pairs/beams] in one report [where at least one [pair/beam] associated with a PCI different from serving cell PCI can be reported] (FFS: if K is a component candidate value)**Basic**3. The maximum number of [RRC-configured] PCI(s) different from serving cell PCI for L1-RSRP measurement] (FFS: whether to split this for FR1 and FR2) (FFS: whether/how to capture different values/behaviors for periodic/aperiodic/semi-persistent L1-RSRP measurement)**Basic**[==============================]~~[~~4. The max number of SSB resources configured to measure L1-RSRP within a slot with PCI(s) same as or different from serving cell PCI [across all CC]~~]~~**Basic**~~[~~5. The max number of SSB resources configured to measure L1-RSRP with PCI(s) same as or different from serving cell PCI [across all CC]~~]~~**Basic**[==============================]~~[~~6. Support on that SSB(s) with PCI(s) different from serving cell PCI configured for L1 beam measurement and report are not included in SSBs with PCIs configured for L3 mobility measurement~~]~~**New FG or Basic**[==============================]~~[~~7. The maximum number of configured additional PCIs is X1 when time domain positions and periodicity of configured SSBs with additional PCIs are the same as time domain positions and periodicity of the serving cell SSBs~~]~~**Basic**~~[~~8. The maximum number of configured additional PCIs is X2 when time domain positions and periodicity of configured SSBs with additional PCIs are different with time domain positions and periodicity of the serving cell SSBs~~]~~**Basic**[==============================][9. Supported mode inter-cell measurement: {inside SMTC, both inside and outside SMTC}]**New FG or Basic**[10. Supported mode of measurement over overlapped SSBs: {overlapped, both overlapped and non-overlapped}]**New FG or Basic**[==============================]~~[~~11. Maximum number of overlapped SSBs in one SSB resource for L1-RSRP measurement~~]~~**New FG or Basic**[==============================]~~[~~12. The maximum total number of SSB/CSI-RS/CSI-IM resources configured to measure within a slot across all CCs in one frequency range for any of L1-RSRP measurement, L1-SINR measurement, pathloss measurement, BFD, RLM and new beam identification for both intra-cell and inter-cell measurement (Similar to FG 16-1g)~~]~~**New FG**~~[~~13.[The maximum total number of SSB/CSI-RS/CSI-IM resources configured across all CCs in one frequency range for any of L1-RSRP measurement, L1-SINR measurement, pathloss measurement, BFD, RLM and new beam identification for both intra-cell and inter-cell measurement (Similar to FG 16-1g)~~]~~**New FG** | [2-24, 2-29] |  |  |  | [per band] |  |  |  |  | Optional with capability signalling |

[R1-2200936](../../Docs/R1-2200936.zip) Rel-17 UE features for further NR MIMO enhancements Huawei, HiSilicon

[R1-2201120](../../Docs/R1-2201120.zip) Discussion on remaining issues of FeMIMO features vivo

[R1-2201199](../../Docs/R1-2201199.zip) UE features for feMIMO ZTE

[R1-2201230](../../Docs/R1-2201230.zip) UE features for further enhancements on NR-MIMO OPPO

[R1-2201344](../../Docs/R1-2201344.zip) On UE features for Rel-17 feMIMO CATT

[R1-2201408](../../Docs/R1-2201408.zip) On UE features for further enhancements on NR-MIMO Nokia, Nokia Shanghai Bell

[R1-2201501](../../Docs/R1-2201501.zip) Discussion on Rel.17 FeMIMO UE features NTT DOCOMO, INC.

[R1-2201562](../../Docs/R1-2201562.zip) Discussion on UE features for FeMIMO Spreadtrum Communications

[R1-2201574](../../Docs/R1-2201574.zip) Discussion on Rel-17 UE feature for NR FeMIMO LG Electronics

[R1-2201723](../../Docs/R1-2201723.zip) On UE features for feMIMO Intel Corporation

[R1-2201791](../../Docs/R1-2201791.zip) Views on Rel-17 FeMIMO UE features Apple

[R1-2201882](../../Docs/R1-2201882.zip) Discussion on UE features for FeMIMO CMCC

[R1-2201952](../../Docs/R1-2201952.zip) Discussion on UE features for FeMIMO Xiaomi

[R1-2202038](../../Docs/R1-2202038.zip) Views on UE features for Rel-17 NR FeMIMO Samsung

[R1-2202058](../../Docs/R1-2202058.zip) UE Features for further enhancements on NR MIMO MediaTek Inc.

[R1-2202092](../../Docs/R1-2202092.zip) Discussion on UE features for FeMIMO Lenovo

[R1-2202165](../../Docs/R1-2202165.zip) Discussion on FeMIMO UE features Qualcomm Incorporated

[R1-2202282](../../Docs/R1-2202282.zip) Discussion on UE features for FeMIMO Ericsson