**3GPP TSG RAN WG1 #107-e R1-2112680**

**e-Meeting, November 11th – 19th, 2021**

**Agenda item:** 8.1.1

**Source:** Moderator (Samsung)

**Title:** Moderator summary#3 for multi-beam enhancement: ROUND 2

**Document for:** Discussion and Decision

## Introduction

In this summary, the term “item 1” refers to the first item in the Rel.17 NR FeMIMO WID, i.e. multi-beam enhancement:

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| 1. Enhancement on multi-beam operation, mainly targeting FR2 while also applicable to FR1:
	1. Identify and specify features to facilitate more efficient (lower latency and overhead) DL/UL beam management for intra-cell and inter-cell scenarios to support higher UE speed and/or a larger number of configured TCI states:
		1. Common beam for data and control transmission/reception for DL and UL, especially for intra-band CA
		2. Unified TCI framework for DL and UL beam indication
		3. Enhancement on signaling mechanisms for the above features to improve latency and efficiency with more usage of dynamic control signaling (as opposed to RRC)
		4. For inter-cell beam management, a UE can transmit to or receive from only a single cell (i.e. serving cell does not change when beam selection is done). This includes L1-only measurement/reporting (i.e. no L3 impact) and beam indication associated with cell(s) with any Physical Cell ID(s)
			1. The beam indication is based on Rel-17 unified TCI framework
			2. The same beam measurement/reporting mechanism will be reused for inter-cell mTRP
			3. This work shall only consider intra-DU and intra-frequency cases
	2. Identify and specify features to facilitate UL beam selection for UEs equipped with multiple panels, considering UL coverage loss mitigation due to MPE, based on UL beam indication with the unified TCI framework for UL fast panel selection
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This summary includes the following:

* Observation and proposal
* Summary of current companies’ positions on each of the aspects within the category

## Summary of companies’ inputs

### Issue 1 (Rel.17 unified TCI framework – note: for intra-cell beam management unless otherwise noted)

Table 1 Summary: issue 1

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| **#** | **Issue** | **Companies’ views** |
| 1.1 | **Proposal 1.A.1**: On Rel-17 unified TCI framework, any SRS resource or resource set that is a valid target signal of a Rel-15/16 spatial relation based on the Rel-15/16 spatial relation rules (on source-target relations) can be configured as a target signal of a Rel-17 UL or, if applicable, joint TCI (hence the Rel-17 UL or, if applicable, joint TCI state pool).* Note: This does not imply that DL and UL TCI state pools are separate or shared for separate DL/UL TCI (this issue is up to RAN2)

**FL Note**: Discussed offline [1] | **Support/fine**: Sony, Nokia/NSB, Ericsson, Samsung, MTK, Fraunhofer IIS/HHI, CMCC, Futurewei, Intel, vivo, NEC, AT&T, NTT Docomo, QC, CATT, Xiaomi, LG, TCL, Lenovo/MotM, Convida, Huawei, HiSi**Concern**: OPPO, ZTE**Objected by**: OPPO |
| 1.2 | **Proposal 1.A.2**: On Rel-17 unified TCI framework, for any SRS resource or resource set that does not share the same indicated Rel-17 TCI state(s) as dynamic-grant/configured-grant based PUSCH and all of dedicated PUCCH resources, but can be configured as a target signal of a Rel-17 UL or, if applicable, joint TCI (hence the Rel-17 UL or, if applicable, joint TCI state pool), Rel-17 mechanism(s) which reuse mechanisms similar to the Rel-15/16 spatial relation info update signaling/configuration design(s) are used to update/configure such SRS(s) with Rel-17 UL or, if applicable, joint TCI state(s).* Applies for both intra-cell and inter-cell beam indication
* Note: It is up to RAN2, if needed, to design MAC-CE signaling for the Rel-17 mechanism(s) which reuse mechanisms similar to the Rel-15/16 spatial relation info update signaling/configuration design(s)
* [All the Rel-17 UL or, if applicable, joint TCI states configured/activated to SRS resources in the same set are associated with the same UL PC setting]

**FL Note**: Discussed offline [1] | **Support/fine**: Sony, Nokia/NSB, Ericsson, Samsung, MTK, Fraunhofer IIS/HHI, CMCC, Futurewei, Intel, NEC, AT&T, NTT Docomo, QC, CATT, Xiaomi, [Apple], LG, TCL, Lenovo/MotM, Convida**Concern**: OPPO, ZTE**Objected by**: [OPPO] |
| 1.3 | **Proposal 1.A.3**: The UE is not expected to be configured with Rel-15/Rel-16 TCI/SpatialRelationInfo if the UE is configured with Rel-17 TCI in any CC in a band**FL Note**: Discussed offline [1]. Suggest to remove brackets around [in a band] and remove the bullet. | **Support/fine**: Nokia/NSB, Ericsson, Samsung, Apple, MTK, Fraunhofer IIS/HHI (remove bullet), CMCC, Futurewei, vivo, NEC, AT&T, QC (remove bullet), CATT (remove bullet), Xiaomi, TCL, Lenovo/MotM (remove bullet), Convida, NTT Docomo (concern without bullet or without “in a band”), Sony (if “in a band” is kept), Intel (ok “in band”, not ok with bullet)**Concern**: OPPO**Objected by**: [OPPO] |
| 1.4 | **Proposal 1.E:** On Rel.17 unified TCI framework, for Rel-17 unified TCI, for DL channels/signals that share the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH/PDCCH (via Rel-17 MAC-CE/DCI TCI state update), the following option on source RSs and QCL-Types is also supported:* Option 3: CSI-RS for CSI is configured for QCL-TypeA and QCL-TypeD source RS

**FL Note**: It was explained that the so-called “circular” issue is avoided in practice via NW implementation, i.e. NW will not configure the same CSI-RS for CSI both as source and target RSs. | **Support/fine (23)**: Huawei/HiSi, Ericsson, CMCC, Samsung, Sony, Qualcomm, Fraunhofer IIS/HHI, Futurewei, MTK, NTT Docomo, AT&T, Lenovo/MotM, Intel, Xiaomi, CATT, TCL, ZTE **Concern**: Apple (object), OPPO, Nokia/NSB  |
| 1.5 | **Working Assumption**For Rel-17 unified TCI framework, on applying the indicated Rel-17 TCI state to PDCCH reception and the respective PDSCH reception, for intra-cell and inter-cell BM, support per CORESET determination as follows:* For any PDCCH reception on a CORESET [other than CORESET#0] that is associated with [at least or only] [USS and/or CSS type 3] set(s) and the respective PDSCH reception, UE always applies the indicated Rel-17 TCI state.
* For any PDCCH reception on [CORESET#0 or] a CORESET [(other than CORESET#0)] that is not associated with any [USS and/or CSS type 3] set and the respective PDSCH reception, whether or not UE to apply the indicated Rel-17 TCI state is determined per CORESET by RRC
	+ Note: It was agreed that a UE can receive non-UE dedicated signal/channel only from the serving cell
	+ Above applies only for intra-cell beam indication
* [For inter-cell beam indication, a UE may expect that a CSS and a USS are not associated with a same CORESET]

**FL Note**: 3 open issues to finalize | **CORESET#0:*** **Remove brackets (include):**
* **Keep brackets (FFS and address in maintenance): QC**

**USS and/or CSS Type 3:*** **Only USS: QC**
* **USS and CSS Type 3:**

**CORESET association with both CSS and USS:*** **For both intra- and inter-cell:**
* **Only for intra-cell:**
* **Not supported: QC**
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Table 2 Additional inputs: issue 1

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| **Company** | **Input** |
| Mod V0 | 1. **Check and update your view in Table 1**
2. **Share more inputs here if needed**

**FL comment:** * **The concerns on 1.A.1/2/3 should have been resolved with the 3rd bullet in 1.A.2 (**All the Rel-17 UL or, if applicable, joint TCI states configured/activated to SRS resources in the same set are associated with the same UL PC setting**)**
* **Re Nokia’s concern on 1.E, there mihht be some misunderstanding from Nokia since Opt3 is actually supported in Rel-15/16 QCL rule as repeatedly pointed out by the proponents**
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| Qualcomm | For the 3 open issues in 1.5:* For COREESET #0, we share the same view as Apple that it can be configured for both CSS and USS. We suggest no such restriction, i.e. the proposal should be applicable to all CORESETs in general. Prefer to remove the text or at least keep the brackets
* For Type3 CSS, we prefer to only keep USS, i.e. all CSSs should be counted as non-UE dedicated. But can also be flexible on this issue
* For CORESET association with CSS/USS, we prefer to have same CORESET associated with either USS or CSS for both intra and inter-cell as compromise. Ideally, we believe per SS is the most straightforward way to align with the previous agreement. The operation rule should also be simple: Same CORESET can use the indicated R17 TCI if associated with USS, and share the same indicated R17 TCI or use a different TCI indicated by R15/16 signaling if associated with CSS.
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### Issue 2 (inter-cell beam management)

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### Issue 3 (signaling medium)

Table 5 Summary: issue 3

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| **#** | **Issue** | **Companies’ views** |
| 3.1 | **Proposal 3.B**: Refine the following agreement as follows:AgreementOn Rel-17 DCI-based beam indication, regarding application time of the beam indication, the UE is configured with at least one beam application time (BAT) ~~[~~per BWP per CC~~]~~* Note: It was agreed that the BAT associated with the carrier(s) (hence BWP(s)/CC(s)) on which the beam indication applies is determined on the carrier with the smallest SCS among the carrier(s) (hence BWP(s)/CC(s)) applying the beam indication
* TBD (RAN1#107-e): whether a second configured BAT is also supported, e.g. for MPUE or inter-cell BM, [per BWP per CC]
* ~~TBD (RAN1#107-e): Whether or not t~~The UE may assume that BWPs configured with same SCS ~~[in a same CC group]~~ share a same value of BAT

**FL Note**: This is the current situationOne BAT per BWP per CC, no constraint:* **Support/fine**: ZTE, Qualcomm, Ericsson, Intel
* **Concern**:

One BAT per BWP per CC, BWPs with same CSC (in a same CC group) share a same BAT (yellow):* **Support/fine**: Samsung, Sony, OPPO, Apple, MTK, NTT Docomo, Xiaomi, vivo, Intel, Lenovo/MotM
* **Concern**:
 | **Support/fine**: Samsung, Sony, OPPO, Apple, MTK, NTT Docomo, Xiaomi, vivo, Intel, Lenovo/MotM, QC**Concern**: |

Table 6 Additional inputs: issue 3

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| **Company** | **Input** |
| Mod V0 | 1. **Check and update your view in Table 5**
2. **Share more inputs here if needed**
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| Qualcomm | Fine with Proposal 3.B |
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### Issue 4 (MP-UE)

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# References

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| 1 | R1-2111716 | Summary of offline discussion on unified TCI, inter-cell beam management, and MPUE | Moderator (Samsung) |