**3GPP TSG RAN WG1 #108-e R1-2202607**

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

**Agenda item:** 8.1.1

**Source:** Moderator (Samsung)

**Title:** Moderator Summary#2 for Maintenance on Rel-17 Multi-Beam: ROUND 1

**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 |

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** |
| 1.9 | On Rel-17 unified TCI framework, for P/SP-CSI-RS, the UE assumes that:   * Alt2. Whether to apply the indicated Rel-17 TCI state is configured per CSI-RS resource by RRC – if not applied, use the legacy MAC-CE signalling mechanism * Alt3. The indicated Rel-17 TCI state is never applied, i.e. the legacy RRC/MAC-CE signalling mechanism is always used * Alt4. The indicated Rel-17 TCI state is applied when the UE is not configured with any TCI state for the P/SP CSI-RS   **FL Note**: Open issue that needs to be resolved.  From FL perspective, I agree with companies who stated that ***if there is no additional consensus on this issue, Alt3 is the default scheme/outcome.*** | **Alt2:** Fraunhofer IIS/HHI (2nd pref.), LG, Nokia/NSB, Samsung, CATT, Lenovo/MotM, NTT Docomo (2nd pref.)  **Alt3:** MTK (add RRC), Qualcomm, OPPO, Xiaomi, ZTE, Spreadtrum, vivo, Futurewei, Huawei/HiSi  **Alt4:** Apple, Ericsson, NTT Docomo, Fraunhofer IIS/HHI, TCL, CMCC, Intel |
| 1.12 | 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. **Need conclusion**. | **Support/fine**: Sony, CMCC, Ericsson, Qualcomm, NTT Docomo, Fraunhofer IIS/HHI, Nokia/NSB, TCL, CMCC, CATT, ZTE, Spreadtrum, vivo, Futurewei, Intel, ZTE, Lenovo/MotM, Samsung  **Not support:** Apple |
| 1.13 | For cross-carrier scheduling, support cross-carrier DCI-based TCI state indication  **FL Note**: Spec impact of this proposal is unclear. Before this is fully clarified by the proponents, the discussion is suspended. *So far only Qualcomm has a concrete proposal.* | **Support/fine:** Qualcomm (extra latency for xCC beam indication),Samsung, Nokia/NSB, Xiaomi, CMCC, CATT, vivo, Futurewei, Huawei/HiSi  **Not support:** Ericsson (no spec impact), Intel (already supported), MTK (support by default), NTT Docomo (supported by default), Fraunhofer IIS/HHI (supported by default), Lenovo/MotM (by default) |
| 1.14 | Proposed **conclusion:** On path-loss measurement for Rel.17 unified TCI framework, when both PL-RS and spatial relation RS in the UL or (if applicable) joint TCI state are not the same, whether and how to define the event(s) of “beam alignment” is left to RAN4.  **FL Note:** Any additional event (bullet) doesn’t seem acceptable for a number of companies. Even the above, some still have concern. **Need conclusion or leave to RAN4**. | **Support/fine (original FL proposal in ROUND 0):** MTK, Samsung, Qualcomm, NTT Docomo, Nokia/NSB, TCL, CMCC, CATT, vivo, Futurewei, Lenovo/MotM, NTT Docomo  **Not support:** Ericsson (leave to RAN4) Intel (leave to RAN4), ZTE, Huawei/HiSi |
| 1.15 | Support to report virtual PHR based on the power control parameters associated with indicated TCI state for PUSCH/PUCCH transmission. | **Support/fine:** Apple, ZTE  **Not support:** Intel, Samsung, Qualcomm |

Table 2 Additional inputs: issue 1

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| **Company** | **Input** |
| Mod V0 | 1. **Check and update your view in Table 1**     1. **Issue 1.13, if proponents cannot come up with a concrete proposal (feel free to discuss offline), I will suspend this issue from discussion. Most companies think that this is already supported.** 2. **Share more inputs here if needed** |
| Qualcomm | For 1.9, support Alt3  For 1.12, support  For 1.13, below is our proposal. Note that the UE capability is defined from end of DCI to the application time  **Proposal : If the TCI updating DCI has smaller SCS than the applied channel(s), the time gap between DCI and the application time should be no less than the corresponding UE capability plus an additional value to account for extra DCI decoding latency.**   * **Value may reuse the additional beam switching timing delay d defined in 38.214 Table 5.2.1.5.1a-1.**   **Agreement**  On Rel-17 DCI-based beam indication, regarding application time of the beam indication, the first slot that is at least X ms or Y symbols after the last symbol of the acknowledgment of the joint or separate DL/UL beam indication.  Note: The gap between the last symbol of the beam indication DCI and that first slot shall satisfy the UE capability  For 1.14, prefer to clarify in RAN1. RAN4 does not know the context and may send LS for RAN1 to clarify. Without any clarification, this capability may not work well  For 1.15, not critical |
| Apple | 1.9: It would be very helpful for UE implementation to have a default beam assumption for periodic CSI-RS, which creates several issues for R15. So we think Alt4 is a good approach to figure out this issue, otherwise, we need another rule to define the default beam.  1.12: According to our understanding, this issue is not a valid issue for maintenance phase.  1.13: Maybe we can directly discuss TP to see potential spec impact.  1.14: OK  1.15: With unified TCI, it is easy to report a meaningful virtual PHR as proposed. Current virtual PHR is always based on a default PC parameters, which is not useful for multi-beam operation. So we think this proposal should be supported. |
| Samsung | **Issue 1.9**: Support Alt2  **Issue 1.12:** OK  **Issue 1.13:** Support. Below is our proposal:  In RAN1#104bis-e, we have agreed to keep the carrier indicator field in DCI Format 1\_1 and DCI Format 1\_2 to be used for beam indication, without a DL assignment:  **Agreement RAN1#104bis-e**  For beam indication with Rel-17 unified TCI, support DCI format 1\_1/1\_2 without DL assignment:   * … * In addition, use the following DCI fields as the fields are being used in Rel-16:   + Identifier for DCI formats   + Carrier indicator   + …   This implies cross-carrier beam indication is supported. This should be mentioned in the specifications. As a side note, 38.213 already mentioned cross-carrier scheduling. However, we don’t believe that this can be extended to cross carrier beam indication without explicitly mentioning in the specifications. Therefore, we suggest the following TP:  The UE with activated [*TCI-State]* configured with [*tci-StateId\_r17]* receives DCI format 1\_1/1\_2 providing indicated *TCI-State* with[*tci-StateId\_r17]* for a CC or all CCs in the same CC list configured by *[simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2]*. The DCI format 1\_1/1\_2 can be with or without, if applicable, DL assignment. If the DCI format 1\_1/1\_2/ is without DL assignment, the UE can assume the following:  - CS-RNTI is used to scramble the CRC for the DCI  - The values of the following DCI fields are set as follows:  - RV = all '1's  - MCS = all '1's  - NDI = 0  - Set to all '0's for FDRA Type 0, or all '1's for FDRA Type 1, or all '0's for dynamicSwitch (same as in Table 10.2-4 of [6, TS 38.213]).  If a UE is configured with *CrossCarrierSchedulingConfig* for a serving cell the value of the DCI field ‘*carrier indicator*’ corresponds to the value indicated by *CrossCarrierSchedulingConfig.* The codepoint indicated by the DCI field ‘*Transmission Configuration Indicator*’ is applied to the carrier indicated by the DCI field ‘*carrier indicator*’.  **Issue 1.14:** Prefer to discuss and conclude in RAN1, but if majority wants to handle in RAN4, this is also fine.  **Issue 1.15**: Is this necessary? Based on the current spec a UE calculates the PHR based on the power control parameters associated with PUSCH. When the PUSCH follows the indicated TCI, the power control parameters associated with the indicated TCI state are used. Therefore, we don’t think there is a need for further agreements.  **Issue 1.11** from Round 0 seems to have been removed, we think that this is needed, with the following update:  For Rel-17 unified TCI framework, ~~in RAN1#107-e,~~ for the Rel-17 TCI state indication of CORESET 0, the UE assumes TCI state based on latest RA procedure, not initiated by a PDCCH order that triggers a contention-free random access procedure, if no TCI state is indicated after RA procedure.  This follows a similar behavior in Rel-15/16 where after RA, CORESET 0 follows the QCL assumptions/spatial filters used in RA until a new TCI state is activated for CORESET 0. This is on top of the agreement made in Tuesday’s GTW. When CORESET 0 is configured to follow the unified TCI state, between the most recent random access procedure and the indication of a new TCI state, CORESET 0 follows the QCL assumptions based on the most recent contention-based random access procedure. After the UE is indicated a unified TCI state, CORESET 0 follows that TCI state. |
| MediaTek | **Issue 1.13**   * Regarding x-carrier beam indication using DCI 1\_1/1\_2 w/o DLA, to our understanding, there is no explicit description in current spec to clarify the DCI fields for PDSCH/PUSCH scheduling shall apply to a certain carrier indicated by carrier indicator. We think it may not be necessary to have it only for beam indication. * Regarding whether to add an additional delay in BAT for x-carrier beam indication, at least we don't see the need since the definition of BAT in Rel-17 TCI is quite different from *timeDurationforQCL*.   **Issue 1.15:** We have a similar question as Samsung. What’s the difference between the PC for PUSCH and the PC associated with the indicated TCI state if PUSCH always follows the indicated TCI state? |
| NTT DOCOMO | **1.9:** support either Alt.2 or Alt.4.  **1.12:** support.  **1.13:** Regarding to cross carrier scheduling, we should check which SCS of scheduling DCI or scheduled PDSCH BAT is counted in the current spec. The latest 38.214 says:  ---  The first slot and the BeamAppTime\_r17 symbols are both determined on the carrier with the smallest SCS among the carrier(s) applying the beam indication.  ---  The current spec. is clearly says the SCS of the scheduled CC is applied (not SCS of scheduling CC). This is Hence, we don’t think the discussion is needed.  **1.14:** OK |

### Issue 2 (inter-cell beam management)

Table 3 Summary: issue 2

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| **#** | **Issue** | **Companies’ views** |
| 2.1 | For the already agreed NW-controlled inter-cell beam reporting, support reporting L1-RSRP for the subset of configured SSBs detected during the L3 measurement | **Support/fine:** Ericsson, vivo  **Not support:** Qualcomm, Nokia/NSB (RAN4 issue), Samsung, OPPO, Xiaomi, CMCC, CATT, Spreadtrum, ZTE (UE implementation), Lenovo/MotM, MTK (supportive but RAN4) |
| 2.4 | MAC CE activates non-serving cell SSBs for measurement  **FL note**: This was discussed several times before and needs **conclusion** | **Support/fine:** ZTE, Apple, Qualcomm, NTT Docomo, Xiaomi (for AP), CMCC, CATT, vivo, Futurewei  **Not support:** MTK, Ericsson (already supported implicitly), Samsung (already supported implicitly), OPPO, LG , Intel, Spreadtrum, Lenovo/MOtM (implicit), Huawei/HiSi (implicit) |
| 2.5 | For inter-cell cases, default beam mechanism should be determined separately.   * + For non-UE-dedicated DL channels/RSs, reuse legacy default beam mechanism defined in Rel-15/16 to obtain their QCL assumption respectively;   + For UE-dedicated DL channels/RSs, follow the previous indicated TCI-state-r17; | **Support/fine:** vivo  **Not support:** QC (always use indicated TCI), Samsung, MTK |
| 2.6 | For inter-cell case with one TCI pool configured within a set of CCs, when different PCIs are associated with the TCI states in different CCs, it should be allowed that the same TCI state ID can refer to different PCI on different CCs. | **Support/fine:** vivo  **Not support:** QC (NW implementation), Samsung, MTK (NW implementation) , NTT Docomo |
| 2.7 | PDCCH/PDSCH is rate matched around the SSBs configured for L1-RSRP measurement, besides SSBs associated with the same PCI as that of the activated/indicated TCI state of the PDCCH/PDSCH. | **Support/fine:** vivo, QC  **Not support: Samsung**, NTT Docomo |
| 2.8 | For UE with activated with more than one TCI state,   * 1) if the symbols of paging/short message/SI from serving cell are **not overlapped** with the symbols of DL signals from non-serving cell, UE receives both. * 2) if at least one symbol of paging/short message/SI from serving cell **is overlapped** with the symbol of DL signals from non-serving cell, UE receives paging/short message/SI. | **For 1),**  **Support/fine:** NTT Docomo  **Not support:**  **For 2),**  **Support/fine:** NTT Docomo  **Not support:** |

Table 4 Additional inputs: issue 2

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| **Company** | **Input** |
| Mod V0 | 1. **Check and update your view in Table 3**     1. **Added 2.5/6/7 per vivo’s request at the end of ROUND 0 (please see vivo’s explanation below and share your view)** 2. **Share more inputs here if needed** |
| vivo | **Issue 2.5**: default beam mechanism in inter-cell case  DL channels/RSs are divided into two categories in Rel-17, non-UE-dedicated and UE-dedicated, where in inter-cell cases, non-UE-dedicated DL channels/RSs are defined as the DL channels/RSs associated with non-UE-dedicated CORESET and follow R15/16 TCI state deactivation/activation and indication mechanism, while the QCL assumption of DL UE-dedicated channels/RSs follows the indicated TCI-state-r17. Therefore, the default QCL assumption of DL channels/RSs should also be determined separately.   * For UE-dedicated DL channels/RSs, they follow the previous indicated TCI-state-r17; * For non-UE-dedicated channels/RSs, reuse legacy default beam mechanism defined in Rel-15/16 to obtain their QCL assumption respectively.   Proposal: For inter-cell cases, default beam mechanism should be determined separately.   * + For non-UE-dedicated DL channels/RSs, reuse legacy default beam mechanism defined in Rel-15/16 to obtain their QCL assumption respectively;   + For UE-dedicated DL channels/RSs, follow the previous indicated TCI-state-r17;   **Issue 2.6:** beam indication across CCs  For inter-cell case with one TCI pool configured within a set of CCs, when different PCIs are associated with the TCI states in different CCs, it should be allowed that the same TCI state ID can refer to different PCI on different CCs.  Proposal: For inter-cell case with one TCI pool configured within a set of CCs, when different PCIs are associated with the TCI states in different CCs, it should be allowed that the same TCI state ID can refer to different PCI on different CCs.  **Issue 2.7:** rate match for PDSCH and PDCCH  PDSCH/PDCCH from non-serving cell (PCI) associated with TCI state and/or QCL-info is rate matched around non-serving cell SSB with the same PCI, which means per PCI rate match, has been agreed in AI.8.1.2.2.  From UE measurement perspective, when UE is configured to measure on SSBs while still receiving PDSCH on overlapped resources, there would be performance degradations and additional UE complexities to guarantee the corresponding performance. In legacy UE implementation, there is no such simultaneous L1-RSRP measurement and PDSCH reception on the same RE case. We think the same rule also apply to inter-cell measurement in Rel-17. Therefore, PDCCH/PDSCH should also be rate matched around the SSBs configured for L1-RSRP measurement, besides SSBs associated with the same PCI as that of the activated/indicated TCI state of the PDCCH/PDSCH. |
| Qualcomm | For 2.1, not support, it does not work as mentioned before  For 2.4, support  For 2.5, not support. Support indicated TCI as default beam always. Not clear how to define separate default beams for dedicated and non-dedicated signal  For 2.6, the proposal can be achieved by NW implementation to our understanding  For 2.7, fine to support |
| Apple | 2.1: based on the discussion in previous round, it seems this proposal should be discussed in RAN4.  2.5: We agree the default beam should be discussed, but we think a single default beam should be applied as follows.  ***Default beam for PDSCH and aperiodic CSI-RS is based on the beam of CORESET in latest slot across CCs within a CC list, and when there are multiple CORESETs, the one with lower CC ID and CORESET ID is selected.***  2.6: It seems currently this is not prohibited?  2.7: We think not only SSB for L1-RSRP, but also SSB associated with activated TCI needs to be considered. So we suggest the following change.  **PDCCH/PDSCH is rate matched around the SSBs configured for L1-RSRP measurement and SSBs associated with activated TCI states, besides SSBs associated with the same PCI as that of the activated/indicated TCI state of the PDCCH/PDSCH.** |
| Samsung | **Issue 2.1:** Not needed.  The UE should report a subset of SSBs detected during measurement. The subset includes measurements that are within the reporting range. When to perform the measurement can be left for UE’s implementation.  **Issue 2.4**: Not needed. SSBs for measurements can be configured by RRC.  **Issue 2.5:** Not support.There is no need for a default beam. The UE follows the dedicated TCI state.  **Issue 2.6:** Not support. A TCI state is associated with a RS, associated with a PCI. There is no need to have the same TCI state refer to different PCIs.  **Issue 2.7:** Not support.The PDSCH is only rate matched around the SSB of its serving cell/PCI. For L3 handover, the PDSCH is not rate matched around the PDSCH of other neighbouring cells. Rel-17 L1-RSRP measurements can follow the same principle. Furthermore, rate matching around measurement SSBs from various different PCIs is not resource efficient. |
| NTT DOCOMO | **Issue 2.6:** We are not sure the scenario of “the same TCI state ID can refer to different PCI on different CCs” exists. We assume that one given TCI state ID refers the same PCI on all CCs in a band.  **Issue 2.7:** Not support. Same view as Samsung.  **Issue 2.8:** We added 2.8 (paging/short message for UE with more than 1 active TCI states).  In RAN1#108e, we discussed whether UE can receive paging/short message when UE is activated TCI state associated with non-serving cell. That discussion was mainly for UE with one active TCI state.  For UE with more than 1 TCI states, at least TDM between paging/short message and signal from non-serving cell should be allowed. 1) intends this.  Also, when UE receives both “paging/short message” and “signal from non-serving cell” on the same symbol, we’d like UE to receive paging/short message and drop “signal from non-serving cell”. 2) intends this.  We’d like to make agreement at least for 1). If the proposal is not agreed, gNB will have to send many MAC CE to all UEs in a cell, for every time before and after UE receives paging/short message, so that UE can receive paging/short message. From system operational point of view, this has large MAC CE overhead and inefficient. Hence, we’d like to avoid this. |
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### Issue 3 (signaling medium)

Table 5 Summary: issue 3

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| **#** | **Issue** | **Companies’ views** |
| 3.2 | **Proposal 3.B**: On Rel-17 MAC-CE-based and DCI-based beam indication, regarding application time of cross-carrier beam indication, in RAN1#108-e, further discuss and select one from the following alternatives for BAT configuration across CCs when common TCI state ID update is not configured/supported:   * Alt1. The BAT is configured per-CC * Alt2. Use the same scheme as that with common TCI state ID update, i.e. a common BAT is determined by the smallest SCS among all the applied CC(s) in a band * Alt3. A BAT list is configured under the cell group config and applied for each CC in the CG. For CCs not configured with a common TCI state ID update, the BAT is determined by the SCS of the active BWP of the CC.   **FL Note**: Discussed offline [1]. | **Alt1**: Huawei/HiSi, NTT Docomo, Xiaomi, Ericsson (no additional restriction), Samsung, CMCC, Intel (when common TCI state ID update is not configured/supported), MTK (also for non-CA case), NEC, CATT, OPPO, LG, CMCC, Nokia/NSB, TCL, IDC, Spreadtrum  **Alt2:** Qualcomm, ZTE, Apple, Lenovo/MotM, ZTE, Lenovo/MotM  **Alt3**: vivo, Qualcomm |
| 3.3 | On Rel-17 MAC-CE-based and DCI-based beam indication, regarding the CC list for common TCI state ID update and activation, the maximum number of CC lists can be configured is [X]  **FL Note**: Please propose X | **Value of X**: |
| 3.5 | **Proposal 3.D:** For DCI format 1\_1 and 1\_2 with PDSCH assignment indicating TCI state, the acknowledgement to the TCI state update is the ACK of the PDSCH | **Support/fine:** OPPO, Qualcomm, NTT Docomo, NEC, Xiaomi, TCL, CMCC, Intel, ZTE, vivo, Futurewei, Lenovo/MotM, Spreadtrum, Qualcomm  **Not support:** Huawei/HiSi (add “or NACK”) |
| 3.6 | The value range of RRC configured BAT (beamAppTime-r17)   * {0, ..., 14} from NTT Docomo | **Support/fine**: NTT Docomo  **Other proposals**:   * {7, 14, 28, 42, 56, 70, 84, 98}): MTK, Ericsson, Samsung, Qualcomm, NTT Docomo, ZTE * In addition, add smaller values {1, 2, 4}: Samsung, NTT Docomo, vivo (fine with 0), MTK * {24, 28, 42}: Apple |
| 3.7 | **Proposal 3.E**: For Rel-17 unified TCI framework, for the presence of TCI field in DCI format 1-1/1-2, in RAN1#108-e, down-selection from one of the following alternatives:   * Alt1: Reuse *tci-PresentInDCI* to configure TCI field per CORESET * Alt2: Introduce a new RRC parameter to configure TCI field per BWP or per CC * Alt3: TCI field is always present in DCI format 1\_1/1\_2, UE ignores this bit field if one single TCI codepoint is activated   **FL Note**: The proponents note that there is no RRC parameter like *tci-PresentInDCI* to make the TCI field configurable. Even if the majority view is based on tci-PresentInDCI, RAN1 still needs an agreement on this. From FL perspective, this comment is valid. | **Alt1:** Huawei/HiSi, Apple, Ericsson (for single activated TCI state), NTT Docomo, OPPO, LG, TCL, CMCC, CATT, ZTE, Spreadtrum, vivo, Lenovo/MotM  **Alt2:** NTT Docomo (2nd pref.)  **Alt3:** MTK, Samsung, Qualcomm, Nokia/NSB, Intel |
| 3.9 | Regarding TCI indication by DCI without DL assignment, for type-1 HARQ-ACK codebook determination, virtual PDSCH is assumed in the same slot of the DCI by UE. | **Support/fine**: ZTE, Nokia/NSB, Lenovo/MotM (need discussion)  **Not support:** ~~Qualcomm,~~ Apple, OPPO, TCL, CATT, Intel, vivo |
| 3.10 | For DCI formats 1\_1 and 1\_2 without DL assignment, the UCI carrying the HARQ feedback should be mapped to high priority HARQ codebook and PUCCH resources associated with priority index 1 when the UE is configured with two priority indexes. If UE is configured with single priority index, the UCI carrying the HARQ feedback for beam indication should be prioritized over other UCI. | **Support/fine**: Intel  **Not support:** Ericsson (not essential), Qualcomm (no need), OPPO, ZTE, vivo |
| 3.11 | **Proposal 3.B.1**: On Rel-17 DCI-based beam indication, regarding application time of the beam indication for non-CA, the BAT is configured per-CC | **Support/fine**: MTK, Samsung, Intel, Huawei/HiSi, NTT Docomo  **Not support:** Qualcomm (leave to RAN2) |
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Table 6 Additional inputs: issue 3

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| **Company** | **Input** |
| Mod V0 | 1. **Check and update your view in Table 5**     1. **3.5: Proponents to check Huawei’s comment below on adding “or NACK” and comment if it is ok**    2. **3.9: Opposing companies to check ZTE’s argument below. If nothing changes I will suspend this issue from discussion**    3. **3.10: Opposing companies to check Intel’s argument below. If nothing changes I will suspend this issue from discussion** 2. **Share more inputs here if needed** |
| Intel | **Issue 3.10:** If the ACK for beam indication is not mapped to priority 2, it may be dropped and then the gNB and UE will not maintain common understanding of the beam indication. This would mean that the gNB has to re-transmit the DCI which would be a waste of resources and possibly cause misalignment of beams due the increased latency of beam indication. Therefore, we think that the ACK for beam indication should always be prioritized. |
| ZTE | 3.9: If the virtual PDSCH is determined according to SLIV+K0 in the TDRA (which may be misled by the first highlighted part in the following agreement), and then based on the second highlighted part that ACK is reported in a PUCCH k slots after the end of the PDCCH reception where k is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, for HARQ-ACK codebook determination, K1 for determining candidate PDSCH reception becomes ‘PDSCH-to-HARQ\_feedback timing – K0’, which may be out of candidate list for semi-static HARQ-ACK codebook generation (i.e., dl-DataToUL-ACK, dl-DataToUL-ACK-ForDCIFormat1\_2 for providing K1). More details can be found in R1-2101185.  **Agreement (RAN1#104be)**  For beam indication with Rel-17 unified TCI, support DCI format 1\_1/1\_2 without DL assignment:  Use ACK/NACK mechanism analogous to that for SPS PDSCH release with both type-1 and type-2 HARQ-ACK codebook:  Upon a successful reception of the beam indication DCI, the UE reports an ACK  Note that upon a failed reception of the beam indication DCI, a NACK can be reported.  For type-1 HARQ-ACK codebook, a location for the ACK information in the HARQ-ACK codebook is determined based on a virtual PDSCH indicated by the TDRA field in the beam indication DCI, based on the time domain allocation list configured for PDSCH  For type-2 HARQ-ACK codebook, a location for the ACK information in the HARQ-ACK codebook is determined according to the same rule for SPS release  The ACK is reported in a PUCCH *k* slots after the end of the PDCCH reception where *k* is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, or provided *dl-DataToUL-ACK* or *dl-DataToUL-ACK-ForDCI-Format1-2-r16* if the PDSCH-to-HARQ\_feedback timing indicator field is not present in the DCI  …    **Figure 1** Application time of TCI state indication (i.e., Y symbols after ACK) for semi-static HARQ-ACK codebook, where virtual PDSCH is assumed in the same slot of the DCI by UE  So we suggest the proposal to address the issue: Regarding TCI indication by DCI without DL assignment, for type-1 HARQ-ACK codebook determination, virtual PDSCH is assumed in the same slot of the DCI by UE. It should be noticed that the above is aligned with SPS-PDSCH-release. |
| Huawei, HiSilicon | **Proposal 3.D:** This proposal goes against the agreement in RAN1#103e that the ACK/NAK of the PDSCH scheduled by the DCI carrying the beam indication can be used as an ACK also for the DCI (copied below).   |  | | --- | | **Agreement**  On beam indication signaling medium to support joint or separate DL/UL beam indication in Rel.17 unified TCI framework:   * Support L1-based beam indication using at least UE-specific (unicast) DCI to indicate joint or separate DL/UL beam indication from the active TCI states   + The existing DCI formats 1\_1 and 1\_2 are reused for beam indication   + Support a mechanism for UE to acknowledge successful decoding of beam indication     - The ACK/NAK of the PDSCH scheduled by the DCI carrying the beam indication can be used as an ACK also for the DCI     - FFS: Whether any additional specification support is needed |   We suggest updating the proposal as:   * Proposal 3.D: For DCI format 1\_1 and 1\_2 with PDSCH assignment indicating TCI state, the acknowledgement to the TCI state update is the ACK or NACK of the PDSCH |
| QC | For Proposal 3.B, support Alt2 or Alt3. Also, fine to leave to RAN2  For Proposal 3.3, two lists same as legacy  For Proposal 3.D, support. NACK does not work  For Proposal 3.E, support Alt3  For Proposal 3.9, we are fine to at least keep neutral after ZTE’s offline explanation  For Proposal 3.10, not support  For Proposal 3.B.1, leave to RAN2 for the best place |
| Apple | **3.5**: We are ok to add NACK, but currently “NACK” includes DTX. If we want to strictly follow the agreement, we need to consider a scheme to differentiate NACK and DTX. Thus we suggest adding the following FFS.  Proposal 3.D: For DCI format 1\_1 and 1\_2 with PDSCH assignment indicating TCI state, the acknowledgement to the TCI state update is the ACK or NACK of the PDSCH   * FFS: How to differentiate NACK and DTX   3.9: After some discussion, we agree there could be one case that there is no way for UE to report HARQ. We are open to discuss this issue.  3.10: We do not see a big problem without this proposal. |
| Samsung | **Issue 3.2 Proposal 3.B: Support in principle Alt 1.**  Prefer the proposal without the new changes. Not clear what is meaning of “cross-carrier beam indication” This can refer to the carrier-indicator field in the DCI format, not clear if this is the intention of the change. As this should also apply to the scenario where there is a configured list of carrier following the same TCI state without the cross carrier indicator field.  We also suggest the following update:  On Rel-17 DCI-based beam indication, regarding application time of the beam indication for CA, in RAN1#108-e, further discuss and select one from the following alternatives for BAT configuration across CCs ~~when common TCI state ID update is not configured/supported~~:   * Alt1. The BAT is configured per-CC * Alt2. Use the same scheme as that with common TCI state ID update, i.e. a common BAT is determined by the CC(s) with the smallest SCS in a band * Alt3. A BAT list is configured under the cell group config and applied for each CC in the CG. For CCs not configured with a common TCI state ID update, the BAT is determined by the SCS of the active BWP of the CC.   This should also apply to the case that the CCs have a common TCI state update ID. In this case, the BAT follows the CC/BWP with the largest SCS.  **Issue 3.5:** The need for this proposal is unclear.  A NACK can also be considered as an acknowledgment when there is no confusion between NACK and DTX. Or when the UE sends the same TCI state in all DCIs that are mapped to the same codebook.  Perhaps the proponents can explain why this is insufficient (if we miss something). It looks like an optimization.  **Issue 3.6:** Agree to discuss this issue.  In Re1-15, the value timeDurationForQCL depends on the SCS and is given as shown below, maybe this can be considered when deciding the BAT values for Rel-17  timeDurationForQCL SEQUENCE {  scs-60kHz ENUMERATED {s7, s14, s28} OPTIONAL,  scs-120kHz ENUMERATED {s14, s28} OPTIONAL  We can consider values smaller than 7 in Rel-17, we don’t see a strong need to consider all consecutive value between 1 and 7 (an increment of 1). For example, we can consider 1, 2, 4, 7, 14, 28, and a few values higher than 28.  Some values might not be applicable to all SCS.  **Issue 3.7: Proposal 3.E:** Alt3 seems to be the simplest solution  The DCI field ‘*Transmission Configuration Indicator*’ is always present when Rel-17 TCI states are configured.  **Issue 3.9:** We have some concerns as described below …  Frist there are two aspects that need to be determined:   1. The timing location of the PUCCH this is K slots after the PDDCH. Per the agreement, this is not related to the virtual PDSCH. 2. The location of the HARQ-ACK within the codebook. This is determined based on the virtual PDSCH. Per the agreement below, the virtual PDSCH is determined based on the TDRA. It seems that the proposal isn’t according to that agreement.   **Agreement RAN1#104bis-e**  For beam indication with Rel-17 unified TCI, support DCI format 1\_1/1\_2 without DL assignment:   * Use ACK/NACK mechanism analogous to that for SPS PDSCH release with both type-1 and type-2 HARQ-ACK codebook:   + Upon a successful reception of the beam indication DCI, the UE reports an ACK     - Note that upon a failed reception of the beam indication DCI, a NACK can be reported.     - For type-1 HARQ-ACK codebook, a location for the ACK information in the HARQ-ACK codebook is determined based on a virtual PDSCH indicated by the TDRA field in the beam indication DCI, based on the time domain allocation list configured for PDSCH     - For type-2 HARQ-ACK codebook, a location for the ACK information in the HARQ-ACK codebook is determined according to the same rule for SPS release   Based on that there is no need for any further agreements.  **Issue 3.10:**  For the case when there one priority index, the HARQ-ACK associated with the DCI carrying beam indication can be multiplexed with other UCI information. What is the rationale for prioritization in this case?  **Issue 3.11:** Support |
| MediaTek | **Issue 3.3:** We are fine the update from Samsung  **Issue 3.4:** We prefer not to overoptimize during the maintenance phase.  **Issue 3.6:** We are also fine with smaller value {1, 2, 4}  **Issue 3.9:** We are open to discuss this issue.  **Issue 3.10:** Not essential |
| NTT Docomo | **Issue 3.2 (Proposal 3.B):** Support in principle Alt 1. However, we don’t understand why the proposal is only for “cross-carrier beam indication”. We think the proposal should be also applied to “non-cross carrier beam indication”, because it is also not agreed yet.  **Issue 3.3:** X=2 list per band. Note that there should be no spec. limitation of the number of CC lists across all bands. The common TCI state ID update can not be applied to inter-band, thus, we should configure at least one list for all bands where UE support it. This is the difference from Rel.16 simultaneous beam update, which can be applied to inter-band CA.  **Issue 3.5 (Proposal 3.D):** Support. It was agreed that BAT is counted from ACK after RAN1#103e agreement. Also, as discussed in RAN1#107e, for semi-static HARQ codebook, even if UE miss detects DCI, UE sends NACK. ACK/NACK does not work for semi-static HARQ codebook.  **Issue 3.6:** suggest as {1, 2, 4, 7, 14, 28, 42, 56, 70, 84, 98}. There is difference from timeDurationForQCL in Rel.15, which is counted from DCI. On the other hand, BAT is counted from ACK, which is much later than DCI. Hence, we should include smaller value than timeDurationForQCL, to maintain the same beam switching time as Rel.15.  **Issue 3.7:** Support Alt.1. For Alt.1, we suggest to add “tci-PresentDCI-1-2” in Rel.16. We are ok with Alt.2 too.  **Issue 3.11 (Proposal 3.B.1):** Support. |

### Issue 4 (MP-UE)

Table 7 Summary: issue 4

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| **#** | **Issue** | **Companies’ views** |
| 4.1 | **Proposal 4.A**: Confirm the following working assumption as an agreement with the following refinement (highlighted in **red**):  Support the UE reporting a list of UE capability value sets   * Each UE capability value set comprises the max supported number of SRS ports * For any two different value sets, at least one capability value needs to be different   + ~~FFS:~~ In addition also identical value sets are allowed. * Whether the UE capability value set can be common across all BWPs/CCs in same band or BC can be discussed in UE feature session   **FL Note:** Discussed offline [1] | **Support/fine**: MTK, Apple, Nokia/NSB, Fraunhofer IIS/HHI, NTT Docomo, NEC, LG, Qualcomm, OPPO, Xiaomi, LG, CMCC, Spreadtrum, vivo, CATT, Lenovo/MotM, TCL, Huawei/HiSi  **Not support:** Ericsson, Samsung (not support FFS) Intel (do not support identical value sets), Qualcomm (not support identical values) |
| 4.2 | **Proposal 4.B**: On Rel.17 enhancements to facilitate UE-initiated panel activation and selection,   * From the perspective of UE capability, maximum number of supported UL Tx layers = min{maximum number of SRS ports for a reported set, maximum number of UL Tx layers reported by UE ~~capability~~}   **FL Note:** Discussed offline [1] | **Support/fine**: MTK, Apple, Nokia/NSB, NTT Docomo, NEC, LG (in principle), OPPO, Xiaomi, LG, CMCC, CATT, ZTE, Spreadtrum, Lenovo/MotM, Huawei/HiSi  **Not support:** Ericsson (no need to discuss), Samsung, Intel, vivo (spec impact unclear), Qualcomm (no spec impact) |
| 4.3 | **Proposal 4.C**: On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, UE can report one index of UE capability value set for each reported CRI/SSBRI in one beam reporting.  **FL Note:** Discussed offline [1] | **Support/fine**: MTK, Apple, Nokia/NSB, Ericsson, Qualcomm, Fraunhofer IIS/HHI, NTT Docomo, NEC, LG, Samsung, Xiaomi, CMCC, CATT, IDC, Intel, ZTE, Spreadtrum, vivo, TCL, Huawei/HiSi  **Not support:** MotM/Lenovo |
| 4.4 | **Proposal 4.D**: On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, one value of the max supported number of SRS ports (e.g., 0) is reserved to indicate the DL-only panel  **FL Note:** Discussed offline [1] | **Support/fine**: MTK, Ericsson, Qualcomm, NTT Docomo, LG, Xiaomi, CMCC, CATT, Lenovo/MotM  **Not support:** Apple, Nokia/NSB, Fraunhofer IIS/HHI, NEC, Samsung, OPPO, Intel, Spreadtrum, vivo, ZTE |
| 4.5 | **Proposal 4.E**: On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, all types of time-domain behavior, i.e., periodic, semi-persistent, and aperiodic reporting, are supported for the enhanced beam report with index(es) of UE capability value set.  **FL Note:** Discussed offline [1] | **Support/fine**: MTK, Nokia/NSB, Ericsson, Qualcomm (without sub-bullets), Fraunhofer IIS/HHI, NTT Docomo, NEC, LG, Samsung (without sub-bullets), OPPO (without sub-bullets), CMCC, CATT (without sub-bullets), IDC, Intel (without sub-bullets), ZTE (without sub-bullets), Spreadtrum, vivo (without sub-bullets), Lenovo/MotM (without sub-bullets), TCL, Huawei/HiSi  **Not support:** Apple (On SP/AP report) |
| 4.6 | **Proposal 4.F**: On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, regarding acknowledgement mechanism of the reported correspondence from NW to UE, down-select the following alternatives:   * Alt-1: Being based on TCI state activation/update mechanism where the activated TCI state includes reported RS (SSBRI or CSI-RS) [and is additionally associated with the index of UE capability value set]; * Alt-2: A dedicated SS can be configured to send the ACK, which is like PCell-BFR. * Alt-3: A scheme based on the BFR response in SCell BFR * Alt-4: acknowledgement mechanism is not supported. * Alt-5: use the indicated SRS resource set matching the reported SRS port # * Alt-6: No spec impact   **FL Note:** Discussed offline [1]. If there is no consensus, Alt-4 becomes the default outcome. Need to **conclude** this meeting. | **Alt1**: MTK, NTT Docomo, Nokia/NSB, Samsung, ZTE  **Alt2**: OPPO, CMCC, Intel, Apple  **Alt3**: OPPO, CMCC, Intel, Apple  **Alt4**: Ericsson, CATT, Spreadtrum, Huawei/HiSi  **Alt5**: Qualcomm,  **Alt6**: vivo |
| 4.7 | **Proposal 4.G**: On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, regarding how to update the number of SRS ports according to UE reporting, in RAN1#108-e, down-select the following alternatives:   * Alt1: via UL BWP switching where each UL BWP has different number of SRS ports   + FFS: BWP fallback mechanism which would let NW to control UE panel, i.e. switch to a specific UE panel or panel type when timer expires. * Alt2: via SRS resource set selection by DCI where each set has different number of ports   + Note1: ‘SRS resource set indicator’ is already specified in DCI format 0\_1/0\_2 and it provides functionality to select one SRS resource set by the DCI between two SRS resource sets configured by RRC   + Note2: TPMI/TRI mapping for varying number of SRS ports is already specified for fullpowerMode2. * Alt3: via TCI state update/activation mechanism with two options   + Opt1: MAC-CE based TCI state update is targeted to a certain SRS resource set that the SRS resource set if the target set is different from the previous used set.   + Opt2: UE can assume that the SRS resource set which can be triggered (aperiodic) or which is to be used (periodic or semi-persistent) is the one that is associated with the same capability set index as the UE provided in the report together with the reported RS and included in the activated TCI state. * FFS: Any other RRC parameters, e.g., the maximum number of UL layers, codebook subset, uplink full power mode, configuration of SRS for antenna switching and so on, may need to be updated simultaneously with the number of configured SRS ports.   **FL Note:** Discussed offline [1] | **Alt1**: Nokia/NSB, vivo  **Alt2**: Qualcomm, NTT Docomo, NEC, LG, Samsung, OPPO, Xiaomi, CMCC, IDC, ZTE, Lenovo/MotM, Spreadtrum, Huawei/HiSi  **Alt3**:  **Not support:** Apple, Ericsson, MTK |
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Table 8 Additional inputs: issue 4

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| **Company** | **Input** |
| Mod V0 | 1. **Check and update your view in Table 7** 2. **Share more inputs here if needed** |
| QC | For Proposal 4.A, not support the identical values. Not clear the use case  For Proposal 4.B, no spec impact is needed. It should be common sense  For Proposal 4.C, support  For Proposal 4.D, support  For Proposal 4.E, support  For Proposal 4.F, support Alt5.  For Proposal 4.G, support Alt2 |
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### Issue 5 (MPE)

Table 9 Summary: issue 5

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| **#** | **Issue** | **Companies’ views** |
| 5.1 | On Rel-17 enhancements to facilitate MPE mitigation, the SSB/CSI-RS resource set associated with P-MPR reporting should be also associated with L1-RSRP/SINR reporting | **Support/fine**: MTK, Samsung  **Not support**: vivo, ZTE, Qualcomm, LG (unclear), Huawei/HiSi (unclear) |
| 5.2 | The beam-specific P-MPR should be triggered when the P-MPR for indicated UL/joint TCI met legacy condition defined in 38.321, i.e. P-MPR for the indicated TCI is above mpe-Threshold or P-MPR change for this TCI is above phr-Tx-PowerFactorChange | **Support/fine**: Apple  **Not support**: vivo (change beam to panel), ZTE (already supported), Samsung, Qualcomm, LG (change beam to panel), Huawei/HiSi (RAN2/4) |
| 5.3 | For PHR report to facilitate MPE mitigation, reported PCMAX, PH and P-MPR parameters can be associated with the cell which the reported SSBRI/CRI is associated with | **Support/fine**: NEC, ZTE  **Not support**: vivo, Samsung, Qualcomm, Huawei/HiSi |
| 5.2 | Limit the maximum number of P-MPR value larger than mpe-Threshold and without any available SSBRI/CRI to 1. | **Support/fine**: Xiaomi  **Not support**: vivo, ZTE, Samsung, Qualcomm, Huawei/HiSi |

Table 10 Additional inputs: issue 5

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| **Company** | **Input** |
| Mod V0 | 1. **Check and update your view in Table 9** 2. **Share more inputs here if needed** |
| Apple | 5.2: Based on company’s comments, if this issue should be discussed in RAN2 or RAN4, we think we should send an LS to let them know. After some discussion with our RAN2 colleague, they mentioned their understanding is that this should be discussed in RAN1, similar to R16 RAN4-led MPE report where trigger condition is discussed in RAN4.  We suggest the following change to address concern from vivo and LG.  **The ~~beam-specific~~ Rel-17 P-MPR should be triggered when the P-MPR for indicated UL/joint TCI met legacy condition defined in 38.321, i.e. P-MPR for the indicated TCI is above mpe-Threshold or P-MPR change for this TCI is above phr-Tx-PowerFactorChange** |
|  |  |

# References