**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
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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** |
| 1.9 | **Proposal 1.F**: On Rel-17 unified TCI framework, for P/SP-CSI-RS, the UE assumes that the indicated Rel-17 TCI state is never applied, i.e. the legacy RRC/MAC-CE signalling mechanism is always used.**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.*****Current situation:**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

**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, Intel (2nd pref) **Alt4:** Apple, Ericsson, NTT Docomo, Fraunhofer IIS/HHI, TCL, CMCC, Intel  | **Support/fine:** MTK, Qualcomm, OPPO, Xiaomi, ZTE, Spreadtrum, vivo, Futurewei, Huawei/HiSi, Intel, Nokia/NSB, Ericsson**Not support:** CATT (Alt2), Lenovo/MotM (Alt2/4) |
| 1.11 | **Proposal 1.G**: For Rel-17 unified TCI framework, for the TCI state 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.**FL Note**: Revised proposal from Samsung from ROUND 0 | **Support/fine**: Samsung, CATT, Xiaomi, ZTE, Intel**Not support:** MTK (redundant), **Nokia/NSB, Ericsson** |
| 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, Lenovo/MotM, Samsung, LG, Xiaomi, Huawei/HiSi **Not support:** Apple |
| 1.13 | For cross-carrier scheduling **Proposal 1.H**: 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.

**Proposal 1.I**: 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*’**FL Note**: New proposals from Qualcomm and Samsung in ROUND 1 | **Proposal 1.H:*** **Support/fine:** Qualcomm, Xiaomi
* **Not support:** MTK, NTT Docomo, ZTE, CATT, LG, Nokia/NSB, OPPO, Intel, Ericsson

**Proposal 1.I:*** **Support/fine:** Samsung, CATT, Xiaomi, Intel
* **Not support:** MTK, ZTE, LG, Nokia/NSB, OPPO, Ericson
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| 1.14  | **Proposed conclusion 1.J:** 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**. I will move this proposed conclusion to EMAIL ENDORSEMENT 1.**ENDORSED, DISCUSSION IS CLOSED** | **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, Samsung (2nd pref), LG (leave to RAN4) |
| 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, MTK , CATT, Nokia/NSB, Lenovo/MotM, OPPO, Ericsson |

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 Alt3For 1.12, supportFor 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 capabilityFor 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 wellFor 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: OK1.15: 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 |
| Mod V05 | **Revised and added some proposals 1.F, G, H, and I based on comments****Issue 1.14 will be moved to EMAIL ENDORSEMENT 1** |
| LG | Our views are updated in the table.1.12: We are fine with the proposal, and the related circular issue can be addressed by NW implementation.1.13: We think that cross-carrier DCI-based TCI state indication is already supported based on Carrier indicator field in DCI. Hence, the additional agreement seems not needed.1.14: Fine with the proposed conclusion |
| Xiaomi | Proposal 1.F: support Proposal 1.G: fineProposal 1.12: fineProposal 1.H: support Proposal 1.I: fine |
| MediaTek | Proposal 1.F: SupportProposal 1.G: It is unclear why the following sentence agreed in Tuesday’s GTW cannot cover CORESET 0. The proposal seems redundant.*After a UE receives an initial higher layer configuration of more than one [DLorJoint-TCIState-r17] and before application of an indicated TCI state from the configured TCI states:** *The UE assumes that DM-RS of PDSCH and DM-RS of PDCCH, and the CSI-RS applying the indicated TCI state are quasi co-located with the SS/PBCH block the UE identified during the initial access procedure*

Proposal 1.H: Not support. Rel-17 BAT always happens after HARQ-ACK feedback and a UE capability is already define for the gap after HARQ-ACK feedback. It is unclear why the additional delay for the gap after scheduling DCI is needed for Rel-17 BAT. Within a same PUCCH cell group where PUCCH is transmitted in the same CC, what is the difference of the Rel-17 BAT between same-carrier and x-carrier scheduling?Proposal 1.I: Not essential Proposed conclusion 1.J: Fine |
| ZTE | 1.9: Support Alt3. We do not support P/SP CS-RS to be target RS of unified TCI. P/SP CSI-RS should only be maintained by legacy RRC/MAC CE signaling. If following unified TCI state, it would be very complicated.1.11: Fine. 1.12: Support. 1.13: For the proposal itself, it has been supported. No need to discuss again. We agree with Apple that a concrete spec impact can be discussed instead. Regarding “**an additional value to account for extra DCI decoding latency**” proposed by QC, we don’t think it is necessary. We already have “Note: The gap between the last symbol of the beam indication DCI and that first slot shall satisfy the UE capability”, so BAT of UE capability should be set considering the case for cross-CC scheduling with different SCS for CCs. 1.14: Generally agree with QC, prefer to clarify in RAN1. 1.15: Technically reasonable. |
| CATT | 1.9: Support Alt-2. We prefer the same mechanism for P/SP CSI-RS and A CSI-RS.Proposal 1.G: Support1.12: Support.1.13: Support.Proposal 1.H: Not needed. Agree with DCM, this has been covered in the spec.Proposal 1.I: Support1.15: not critical. Rel-15 rule could be reused. |
| Nokia | 1.9: For the progress we are fine with Alt3.1.11: Same view as MediaTek that Proposal 1.G would be redundant.1.12: Ok1.13: We don’t see need for the proposals. 1.14: Ok1.15: We don’t support. PUSCH transmission may have a reference to an SRS resource that is not *sharing* the indicated TCI state.  |
| Lenovo/MotM | 1.9: We believe the behavior of Alt 2 is already supported by the current agreement. Alt 4 is basically the same with Alt 2 with different wording. Both are OK to us.1.12: Support1.14: Support1.15: We do not think it is necessary. We share the same view as Samsung. |
| OPPO | 1.9: we support Alt3. Actually, if we cannot achieve consensus, Alt3 is the natural result. The Alt4 has technical issue: when the CSI-RS is not provided with TCI state, that means it is up to UE to implement Rx beam, which corresponds to P1 procedure. For that, we can not assume any default TCI state.1.13 indeed this has no spec impact. And current spec already supports it.1.14: it is ok to leave it to RAN4.1.15: it is not needed. How to calculate the PHR reporting is clearly specified in current spec. The UE calculates the PHR according to the PC parameters of current PUSCH, which is the ones associated with the indicated TCI state in rel17 unfied TCI state framework.  |
| Samsung | **Issue 1.11 Proposal 1.G:**In reply to MTK and Nokia, the scenario covered by this proposal is in addition to what has been agreed. The agreement made covered the case of determining QCL assumption based on a random access procedure used during initial access and reconfiguration with sync. This proposal covers any contention-based random access procedure that the UE may perform and it only relates to CORESET 0 and not any other CORESET. This behaviour is already part of the legacy behaviour (in TS 38.213, section 10.1). **Issue 1.13 Proposal 1.I:**We have already agreed (in RAN1#104b-e) that “cross indicator” field is already part of the DCI Format without DLA for beam indication. However, the details are not described in the RAN1 specification. TS 38.213, describes cross carrier scheduling (quoted below), however we think that this doesn’t apply to beam indication without DLA. Hence, the need to include in the specifications. |
| Intel | **Issue 1.9:** Alt-4 is preferred but can accept Alt-3 as a second preference**Issue 1.11:** Ok, but we should change the first part of the main bullet as follows: “For Rel-17 unified TCI framework, for ~~the Rel-17~~ TCI state ~~indication~~ of CORESET 0,…” **Issue 1.13: Proposal 1.H –** We don’t think this is needed. Can be handled with appropriate UE capability for BAT with CA; **Proposal 1.I –** Should be supported. Maybe better to directly discuss the TP**Issue 1.14, Issue 1.15:** Views unchanged from previous round |
| Mod V19 | **Minor revision on 1.11 per Intel’s input****@Those not supporting issues 1.11 and 1.13: please check the above explanation from Samsung and see if it addresses your concern** |
| vivo | **Issue 1.9**: Support Alt3 and the Proposal 1.F. There is no agreement about the application of the indicated TCI state for P/SP-CSI-RS. For Alt4, the legacy behavior needs to be clarified when gNB does not configure any TCI state for the P/SP CSI-RS.**Issue 1.11**: For the Rel-17 TCI state indication of CORESET#0, if CORESET#0 is configured to not share the indicated TCI state, legacy signaling mechanism is used, e.g. TCI state activation by legacy MAC CE. Thus, this proposal is updated as follows.**Proposal 1.G**: For Rel-17 unified TCI framework, 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 or activated by MAC CE after RA procedure.**Issue 1.12**: Support the FL Proposal.**Issue 1.13**: The cross-carrier beam indication is already supported. Whether TP is needed can be discussed. Maybe the proponents can directly indicate where to revise the specification. **Issue 1.15**: Don’t support. Agree with Samsung. The current spec is clear for PHR calculation. It is not required to clarify virtual PHR based on the indicated TCI state. |
| ZTE2 | **Regarding Issue 1.13,** in our views, the PDCCH candidate for cross-CC scheduling is monitored individually, and by default, all fields in the DCI for cross-CC scheduling should be interpreted based on the scheduled CC. Therefore, the TCI codepoint should be interpreted based on the activated TCI state pool in scheduled CC rather than scheduling CC. It is the reason why we do not have individual interpretation for each field for cross-CC scheduling in TS 38.212, but we may have some interpretation for BWP switching.  |
| CMCC | **Proposal 1.F:** Fine**Proposal 1.G:** Fine**1.12:** Support**Proposal 1.H:** Not needed.**Proposal 1.I:** Support**Conclusion 1.J:** Support |
| MediaTek | **Issue 1.11 Proposal 1.G:** We are not sure whether it is essential to reset the QCL assumption for CORESET#0 after every CFRA, even it is already supported in Rel-15/16. On the other hand, the proposal is not quite clear. The UE should assume a SSB for QCL instead of a TCI state. Meanwhile, this proposal should be defined for CORESET 0 if it is configured by RRC to apply the indicated Rel-17 TCI state associated with the serving cell (if not, it should follow legacy behaviour).To be clear (even we think this is not essential), we suggest some changes as follows:**Proposal 1.G**: For Rel-17 unified TCI framework, for CORESET 0 configured by RRC to apply the indicated Rel-17 TCI state associated with the serving cell, the UE assumes a DM-RS antenna port for PDCCH receptions in the CORESET is QCLed with an SSB on the UE identified during a latest RA procedure not initiated by a PDCCH order that triggers a contention-free random access procedure, if no MAC-CE or DCI indicating a TCI state after the RA procedure.**Agreement**For Rel-17 unified TCI framework, for the Rel-17 TCI state indication of CORESET 0:* Whether to apply the indicated Rel-17 TCI state associated with the serving cell is configured per CORESET by RRC – if not applied, use the legacy MAC-CE/RACH signalling mechanism

Note: The CSI-RS associated with the Rel-17 TCI state applied to CORESET 0 should be QCLed with an SSB associated with serving cell PCI (same as Rel-15) |
| Huawei, HiSilicon | **Proposal 1.G:** We do not support this proposal. RA procedure does not provide a TCI state, and the conditions of “not initiated…” and “no TCI state is indicated” are confusing. **Proposal 1.H:** Fine with the proposal. When UE reports BAT capability, it doesn’t know whether cross-carrier scheduling will be configured. To prepare for such cases, the UE may always report a large value for BAT, which may not be efficient.**Proposal 1.I:** We suggest clarifying that with cross-carrier TCI indication, the TCI field in the DCI always refer to TCI state in the scheduled/targeted cell, which is indicated by ‘carrier indicator’ in the DCI.**Issue 1.15:** We don't think it’s needed. |
| Nokia | Thanks Samsung for clarification on 1.G and 1.I. We are fine with those proposals.  |
| Lenovo | Proposal 1.F: we are OK with it for the sake of progress. It is a pity that R17 unified TCI can not be applied to P/SP-CSI-RS to reduce the signaling overhead and signaling delay. Proposal 1.G: Support. |

### 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, ZTE**Not support:** Qualcomm, Nokia/NSB (RAN4 issue), Samsung, OPPO, Xiaomi, CMCC, CATT, Spreadtrum, Lenovo/MotM, MTK (supportive but RAN4), Apple (RAN4) |
| 2.4 | MAC CE activates non-serving cell SSBs for measurement**Proposed conclusion 2.A**: On Rel-17 enhancements for inter-cell beam management and inter-cell mTRP, there is no consensus in supporting additional enhancement for MAC-CE activation of non-serving cell SSBs for measurement**FL note**: This was discussed several times before and needs **conclusion****ENDORSED, DISCUSSION IS CLOSED** | **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, NTT Docomo, CATT, Intel, Xiaomi, Lenovo/MotM, OPPO, Intel, Ericsson **Can discuss QCL assumption**: Apple, ZTE, Nokia/NSB |
| 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), Apple (not prohibited), NTT Docomo, ZTE, CATT, Intel, Xiaomi, Lenovo/MotM, OPPO, Ericsson |
| 2.7 | 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. | **Support/fine:** vivo, QC, Apple, CATT**Not support:** Samsung (non-essential, wasteful), ZTE, Intel, Xiaomi, Lenovo/MotM, OPPO , Ericsson (follow agreements in inter-cell mTRP) |
| 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, CATT, Xiaomi, ZTE, CATT, Ericsson**Not support:** **For 2),****Support/fine:** NTT Docomo, Xiaomi, ZTE, Ericsson **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 caseDL 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 PDCCHPDSCH/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 beforeFor 2.4, supportFor 2.5, not support. Support indicated TCI as default beam always. Not clear how to define separate default beams for dedicated and non-dedicated signalFor 2.6, the proposal can be achieved by NW implementation to our understandingFor 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. |
| Mod V05 | **Minor revision on some proposals. Added proposals in 2.8 from NTT Docomo** |
| Xiaomi | **Issue2.5:** Not support. Some specific use cases should be listed if any company wants to support this proposal.**Issue2.6:** Not support. From our understanding, intra-frequency scenario is assumed for inter-cell beam management. We don’t think different PCIs are allowed to be associated with the TCI states in different CCs.**Issue2.7:** Not support. This kind of additional rate matching behaviour has been discussed in Agenda 8.1.2.2 for a long time, and no agreement has been reached. It is not acceptable that neighboring cell SSB should have higher priority than PDCCH/PDSCH from serving cell.**Issue2.8:** Support. |
| ZTE | 2.1: We agree that the **configured** L1-RSRP set can be **a subset of configured** L3 measurement set. But it may need to clarify how to reflect “detected” in the spec. “detected” seems up to UE implementation. 2.4: In current spec, SSB of the neighboring cell can only be measured in SMTC to save UE power. With this proposed scheme , after the SSB of the neighboring cell is activated, the SSB can be measured according to SSB pattern and periodicity configured for the PCI of the neighboring cell without restriction of SMTC. And more PRBs are available for the serving cell due to SSBs which are not activated to measure. Therefore, the scheme is beneficial for power saving, UE complexity reduction, and high efficiency for resource usage. To proponents of “already supported implicitly”: we need to clarify that there is no MAC CE directly activates non-serving cell SSB, especially for **semi-persistent measurement** for SSB. In current 38.331, for the element “resourceType” in CSI-ResourceConfig, it says “Time domain behavior of resource configuration (see TS 38.214 [19], clause 5.2.1.2). It does not apply to resources provided in the csi-SSB-ResourceSetList.” which means no P/SP/AP parameter is configured for SSB measurement. 2.5: After reviewing the current NW design, we believe that, nearly for all cases, the scheduling offset between non-UE dedicated PDCCH and non-UE dedicated PDSCH (e.g., for SIB, RACH, and Paging) is in a same slot or less than the beam-switching threshold reported by the UE. The non-UE dedicated PDSCH should be received or buffered according to the Rel-15/Rel-16 default beam scheme.* Also, considering backward compatibility (for legacy Rel-15/Rel-16 UE), it is impossible for NW to refine the procedure for SIB/RACH/Paging procedure (e.g., to guarantee the scheduling offset larger than or equal to the threshold).

For non-UE-dedicated DL channels/RSs, we are fine for reusing legacy default beam mechanism defined in Rel-15/16 to obtain their QCL assumption respectively, but which may not be exact. In our views, it should be: * **If scheduling/triggering offset for non-UE dedicated PDSCH/AP-CSI-RS is less than a threshold, the corresponding default QCL assumption should be determined according to the monitored CORESET with lowest ID in the latest slot**.

2.6: The case is not prohibited, can be realized by NW implementation.2.7: Not support. If support rate matching around the SSBs configured for L1-RSRP measurement, it would cause low efficiency. We understand that the issue provided by vivo can be avoid via NW implementation. 2.8: Fine. |
| CATT | 2.5: Not support. We prefer to use the indicated TCI state as default beam, which avoids the complicated rules of Rel-15/16.2.6: Not support. This depends on NW implementation.2.7: Support to avoid interference between SSB and PDSCH from different cells2.8: We are fine with 1), which would save MAC-CE signalling. |
| Nokia | 2.5: we think that at least it should be discussed/clarified that what is QCL assumption for the PDSCH reception in serving cell in the following configuration:- UE is configured with CORESET B (for CSS only) in serving cell- UE is configured with CORESET A (for USS) associated with PCI different than PCI of the serving cellE.g. what is the QCL assumption for PDSCH reception in serving cell when scheduling offset in serving cell is less than *timeDurationForQCL* and UE is configured to monitor CORESET B and CORESET A in the same and/or consecutive slots.  |
| Lenovo/MotM | 2.1: Do not support2.5: Do not support. There is no need for default beam. Inter-cell DL channel/RS always follow indicated TCI state.2.6: Do not support. This is can be left for NW implementation. 2.7: Do not support. PDSCH is rate matched around SSB of the serving cell. |
| OPPO | 2.1: It is not needed. The UE is configured with a list of SSB for L1-RSRP. It shall be up to UE implementation to select the SSBs for reporting.2.4: The proposal seems not needed. Measuring L1-RSRP of NSC SSB shall follow the configuration/indication method that are supported in CSI framework and SSBs are configured in RRC. If it is SP measurement, it can be activated by MAC CE, as in current CSI framework.2.5: this proposal is not needed. The system would schedule the transmission properly so that the default beam would be followed as specified in current spec. Introducing more/extra behaviour on default beam only complicate the spec and also system operation, with no benefit.2.6: not sure whether the proposal is correct. If only one pool configured for a list of CCs, the same PCI might be applied to all the CCs, which of course depends on the RRC design in RAN2. 2.7: it looks like not essential issue. |
| Intel | **Issue 2.4:** Ok with conclusion**Issue 2.5:** No need to discuss default beam for non-UE dedicated signals/RSs/channels for inter-cell case. For serving cell, legacy or configured TCI state indication applies as per CORESET A/B/C definitions. For non-serving cell PCID, non-UE dedicated does not apply to the UE from a serving cell PCID.  |
| Mod V19 | **No revision on proposals** |
| vivo | **Issue 2.5:** The motivation of separate default beam mechanism is to make UE behaviour clear when non-UE dedicated PDSCH is in the same slot as the non-UE dedicated PDCCH (typical case). @ Qualcomm @ Samsung @Xiaomi @ CATT There is no doubt that for UE-dedicated channels/RSs, their QCL assumption always follow the indicated TCI state as long as beam application time is satisfied. But for non-UE-dedicated channels/RSs, if the PDSCH and PDCCH are within the same slot, which QCL assumption should be used for the reception? Especially considering the non-UE dedicated signals are from another cell. @ OPPO For typical configurations, the non-UE dedicated PDSCH and PDCCH are within the same slot. @ Intel Current specification is unclear about the behaviour you mentioned. 38.214 only states the starting time of the application of indicated TCI.**Issue 2.6:** @Docomo @OPPO @Xiaomi @Samsung @Docomo, The scenario is for the case when reference BWP/CC is configured with only one TCI state pool, thus TCI states are switched from serving cell to the target cells simultaneously. it is not possible to guarantee the targeting PCIs in different CCs to be the same. Our understanding is that different PCI planning strategy would be used for different frequency.**Issue 2.7:** Currently there is not any rate matching behaviour defined for L1/L2 mobility case, we need agreement on this issue.We are fine with Apple’s revision. Simultaneous reception of SSB for L1-RSRP measurement and PDSCH reception on the same symbol/the same REs would imply new measurement behaviour need to be supported. This should have a well aligned understanding and corresponding agreement.@Samsung, @Docomo, L1-RSRP measurement has more stringent requirement than L3 measurement. And measurement restriction in time domain configuration would also be different for L1-RSRP and L3-RSRP. We need clarification and common understanding on this issue.@Lenovo @OPPO we have not agreed any rate matching behaviour for inter cell BM. The basic rate matching behaviour should be agreed.@Xiaomi Rate matching discussion for Agenda 8.1.2.2 is not related to SSBs configured for L1-RSRP measurement, but rather the SSBs configured in non-serving cell PCI information. Measurement related discussion should be conducted here in Agenda 8.1.1**Issue 2.8:** Not support. The overlapping case should be avoided.  |
| ZTE2 | **Issue 2.5:** After reviewing companies’ input, we think that the potential serious issue may not be explained clearly. It seems that many companies mentioned that the non-UE dedicated PDSCH should not be applied by TCI state from non-serving cell. But, **the question is that the UE can NOT realize whether the non-dedicated PDSCH is transmitted when its scheduling offset is less than a threshold!** |
| CMCC | 2.1: Not needed. It’s up to UE implementation.2.5: Support. Considering backward compatibility, legacy default beam mechanism defined in Rel-15/16 should be reused for non-UE-dedicated channels/RSs.2.6: Not needed.2.7: It may cause low resource utilization. We prefer to reuse the agreements in AI 8.1.2.2. |
| MediaTek | Issue 2.8: Rel-15/16 priority rule for CORESET can resolve the overlapping issue. |
| Huawei, HiSilicon | **Issue 2.6:** We think this proposal is not needed, as companies mentioned above that it is allowed by current specs. **Issue 2.7:** We are not sure whether scheduling restriction would be enforced by RAN4 on SSBs with PCI different from serving cell if they are configured for L1 measurement. We suggest waiting for RAN4 progress.  |
| NTT DOCOMO | **Issue2.6:** Thank you vivo, for your explanation. Our assumed scenario is intra-band co-located CA. In that case, we assume the same TCI state ID on different CC should be associated with the same QCL type D RS (at least the same root SSB). It seems your assumed scenario is non-co-located CA, and hence the same TCI state ID in different CC can be associated with different QCL type D RS (i.e. different root SSB). Is this correct understanding? Also, does common TCI state ID update in Rel.17 support your assumed scenario? In case of TCI state pool sharing, we think the agreement says QCL type D RS or the root SSB should be the same across all CCs in the CC list. In that case, your problem seems not happen.**Issue2.8:** Thank you for your feedbacks!@vivo, MediaTek, I see you have different views on overlapping case. Do you have concern on **non-overlapping case**? 1) of proposal in issue 2.8 discuss non-overlapping case only. |
| Nokia/NSB | **2.5**: Same view as VIVO and ZTE and as we tried to illustrate in our contribution, in inter-cell beam management there may ambiguity in determining the default QCL assumption for PDSCH reception when the UE is having monitoring occasions for ‘CORESET B’ in serving cell and monitoring occasions for ‘CORESET A’ for the PCI different than PCI of the serving cell.Thus, we think that at least it should be clarified that what is QCL assumption for the PDSCH reception in serving cell in the following configuration:- UE is configured with CORESET B (for CSS only) in serving cell- UE is configured with CORESET A (for USS) associated with PCI different than PCI of the serving cellE.g. what is the QCL assumption for PDSCH reception in serving cell when scheduling offset in serving cell is less than *timeDurationForQCL* and UE is configured to monitor CORESET B and CORESET A in the same and/or consecutive slots. **2.6** Up to network to configure.**2.7** Do not support additional rate matching rules for inter-cell BM. There is also no conclusion/concensus in inter-cell mTRP on this issue. **2.8** Support |

### Issue 3 (signaling medium)

Table 5 Summary: issue 3

|  |  |  |
| --- | --- | --- |
| **#** | **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 (carrier aggregation) beam indication, the BAT is configured per-CC**FL Note**: Discussed offline [1]. Super-majority view is Alt1 (similar to Rel-15/16) hence proposed (from FL perspective any of the 3 alternatives works)Summary:* 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.

**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, Lenovo/MotM**Alt3**: vivo, Qualcomm | **Support/fine**: Huawei/HiSi, NTT Docomo, Xiaomi, Ericsson, Samsung, CMCC, Intel, MTK, NEC, CATT, OPPO, LG, CMCC, Nokia/NSB, TCL, IDC, Spreadtrum**Not support**: ZTE (Alt2), Lenovo/MotM (Alt2),  |
| 3.3 | **Proposal 3.F**: 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 2 per band**FL Note**: X=2 following legacy | **Support/fine**: Qualcomm, NTT Docomo, LG, ZTE (open to >2 as well), Nokia/NSB, Lenovo/MotM, Samsung, **Not support**: Ericsson (follow legacy: 2 per cell group)  |
| 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 (NACK doesn’t work), Apple, LG, Nokia/NSB, **Not support:** Huawei/HiSi (add “or NACK”), Samsung, MTK, CATT, Ericsson (no spec impact) |
| 3.6 | The value range of RRC configured BAT (beamAppTime-r17)* {0, ..., 14} from NTT Docomo

**FL Note**: This issue is being discussed as a apart of LS response to RAN2 and won’t be discussed here. | **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, reuse *tci-PresentInDCI* to configure TCI field per CORESET**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 is majority view hence proposed (from FL perspective any of the 3 alternatives works) SUMMARY:* 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

**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 | **Support/fine:** Huawei/HiSi, Apple, Ericsson, NTT Docomo, OPPO, LG, TCL, CMCC, CATT, ZTE, Spreadtrum, vivo, Lenovo/MotM, Xiaomi, MTK, Intel **Not support:**  |
| 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 (discuss), Apple (discuss), MTK (discuss)**Not support:** OPPO, TCL, CATT, Intel, vivo, Samsung, CATT, LG |
| 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, Apple, Samsung, MTK, CATT, Nokia/NSB |
| 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/determined per-CC | **Support/fine**: MTK, Samsung, Intel, Huawei/HiSi, NTT Docomo, CATT, **Not support:** Qualcomm (leave to RAN2) |
|  |  |  |

Table 6 Additional inputs: issue 3

|  |  |
| --- | --- |
| **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 PDSCHFor 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 UESo 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 RAN2For Proposal 3.3, two lists same as legacyFor Proposal 3.D, support. NACK does not workFor Proposal 3.E, support Alt3For Proposal 3.9, we are fine to at least keep neutral after ZTE’s offline explanationFor Proposal 3.10, not supportFor 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-17timeDurationForQCL SEQUENCE { scs-60kHz ENUMERATED {s7, s14, s28} OPTIONAL, scs-120kHz ENUMERATED {s14, s28} OPTIONALWe 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 solutionThe 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. |
| Mod V05 | **Added proposals 3.B and 3.E based on super-majority views** |
| LG | 3.3: Fine with the same number of CC lists of Rel-16 (i.e. 2)3.5: Support. Reporting NACK is performed not only when PDSCH is not detected while UE detects DCI, but also when DCI is not detected. Hence, ‘NACK’ would cause an ambiguous for confirming successful DCI detection.3.9: Similar view with Samsung that it seems not needed. |
| Xiaomi | Proposal 3.B: supportProposal 3.D: support. NACK does not work in some cases. To FL, we propose to discuss the issue that “if there are ACK/NACKs of multiple DCIs indicating different TCI states in one HARQ-ACK codebook, which one TCI state will be applied?” Proposal 3E: fine  |
| MediaTek | Proposal 3.B: SupportProposal 3.D: Not essentialProposal 3.E: Even we still prefer Alt3, we are fine with it if that is majority view. |
| ZTE | 3.2: We can compromise to Alt2, but Alt2 is not clear enough on how to configure BAT for CA.- To our understanding, BAT is configured **per CC group on a reference SCS.** The actual BAT depends on lowest SCS among applied CCs.3.3: X should be at least 2. also open to larger than 2.3.5: agree with Apple’s suggestion.3.7: It seems no need to require TCI field to be always present.3.8: Support Alt1, fine with Proposal 3.E3.9: As we discussed above, the possible issue of “out of candidate list for semi-static HARQ-ACK codebook generation” should be addressed. Clarification to @Samsung and LG: HARQ-ACK codebook has been designed in current spec, we could reuse it well if we assume the same rules. But the issue is caused by the misalignment in the agreement that “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”, where definition of k reuses the time between PDSCH to PUCCH (with HARQ-ACK) in DCI, but k is (mis-)used for the time between PDCCH to PUCCH. That would cause problem by using k(which is **PDSCH-to-HARQ**) as the time PDCCH-to-PUCCH. This misalignment may cause the issue above. The simplest way is to consider virtual PUSCH is in the same slot of the DCI by UE. 3.11: Support. |
| CATT | Issue 3.2(Proposal 3.B): support.Issue 3.5(Proposal 3.D): We have some concerns. If NACK is not used as acknowledgement, the efficiency of the TCI state indication will be greatly reduced. Issue 3.7(Proposal 3.E): Support.Issue 3.9: The benefit of the constraint is not clear. Issue 3.10: The reason to improve the priority of beam indication is not clear.Issue 3.11(Propsoal 3.B.1): Support |
| Nokia | 3.2: Support Proposal 3.B3.3: Ok with 2 (same as in Rel16)3.5: Proposal 3.D Ok3.10: Not seen as essential |
| Lenovo/MotM | 3.2: We prefer Alt 2 for more uniform behaviour within a band. 3.3: We are fine with 2 cc lists per band.3.5: Support Proposal 3.D.3.7: Support Proposal 3.E.3.11: This should be discussed after reaching agreement on 3.2. |
| OPPO | 3.5: Support. Because NR does not define DTX and feedbacking one “NACK” might correspond to the case that the DCI/PDCCH is not correctly received. As specified in 213, when the DCI is not correctly decoded, the UE still feedback ‘NACK’ bit. Thus, the NACK could be wrong indication of receiving beam indication and the consequence is TCI state misalignment. The root reason for that is NR does not define ‘DTX’.@SS: according the specification in 213, if a UE does not receive the DCI/PDCCH correctly, the UE still feedback a NACK bit in the corresponding position in Type-1HARQ codebook. In this case, if NACK is used as acknowledge, the gNB would assume the UE receive the beam indication but the UE actually does not receive the beam indication DCI correctly. Then, it would result in misalignment between system and UE.3.7: Support Alt1. The system should use system implementation to configure properly.3.9: such a restriction is not needed. At least the system implementation should take care of the error case if it exists.3.10: the motivation for prioritizing the beam indication HARQ feedback is not clear. Actually, the HARQ feedback for PDSCH shall have higher priority than that of the beam indication. Dropping the HARQ of PDSCH would cause more resource waste due to the retransmission of whole PDSCH. But beam indication is in DCI and the PDCCH will be transmitted any way.3.11: it intends to say “determined per CC”, right? |
| Intel | **Issue 3.2**: OK with Proposal 3.B**Issue 3.5:** OK to add “or NACK” as suggested by Huawei**Issue 3.7:** Ok with Proposal 3.E for progress |
| Mod V19 | **No revision on proposals****@Those opposing proposal 3.D: please check OPPO’s explanation and see if your concern has been addressed** |
| vivo | **Issue 3.2:** Still prefer Alt3. Proposal 3.B is not Rel-15/16 like since there is no BAT configuration in Rel-15/16.For 3.B, two questions:1. why this is only for “cross-carrier” beam indication? Would the beam indication for the carrier itself also apply the corresponding configured BAT?2. Is the configuration of BAT per CC or per BWP? If there are multiple SCS, would different values be configured for all the SCS?**Issue 3.3:** Similar to Rel-16, maximum number of CC lists can be configured is X under cell group config. There is no need to limit up to 2 CC lists per band.**Issue 3.5:** Support.**Issue 3.6:** Fine with value 0, but not all values between 0 and 7 are required.**Issue 3.7:** Support Alt1 and Proposal 3.E. If a UE does not support DCI-based TCI state indication, the TCI field is not configured in DCI. **Issue 3.9:** Agree with Samsung. The current spec is clear.**Issue 3.10:** It is a corner case and does not require additional discussion.**Issue 3.10:** Not support. |
| NEC | **Issue 3.5:** Support proposal 3.DIn our understanding, the discussed issue only focusing on one HARQ-ACK feedback corresponding to one DCI, while the issue is more severe in case of HARQ-ACK multiplexing, which we think a quite typical use case and which indicated TCI state to be applied should be discussed. So we propose to also consider HARQ-ACK multiplexing to determine a unified solution. **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* **FFS which one of indicated TCI states to be updated in case of HARQ-ACK multiplexing**
	+ **For example, the TCI state(s) indicated in DCI corresponding to last position with ACK value in the HARQ-ACK codebook**
 |
| MediaTek | Issue 3.5: If our understanding is correct, Rel-15/16 MAC-CE based CORESET TCI update & MAC-CE TCI activation are also based on ACK/NACK. If it works in Rel-15/16, why this is an issue in Rel-17? |
| NEC | Issue 3.5:@MTK. In Rel-15/16, there is no misalignment on understanding between gNB and UE on MAC based TCI activation/update, as MAC is actually carried on PDSCH, if MAC (PDSCH) decoding is correct, UE will report ACK and gNB can know UE’s understanding (TCI update/activation command decoding correctly), and if MAC (PDSCH) decoding or DCI decoding is failed, UE will report NACK, and from UE perspective, UE doesn’t know the TCI update/activation command, and from network perspective, gNB can also know UE’s understanding (not aware of the TCI update/activation command), then gNB will not use new TCI, and can retransmit MAC command, i.e. the understanding between UE and gNB is aligned, as shown in Table 1.**Table 1. Rel-15/16 MAC based TCI update/activation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DCI decoding | PDSCH (MAC CE) decoding | HARQ-ACK feedback(based on PDSCH decoding) | Actual decoding result of MAC  | Network can know UE understanding of MAC command |
| Success | Success | ACK | Success | Success |
| Success | Failed | NACK | **Failed** | **Failed** |
| Failed | Failed | NACK | **Failed** |

But for DCI based TCI update, TCI is carried in DCI, but ACK/NACK is feedback for PDSCH, then there will be misalignment, as listed in following table.**Rel-17 DCI based TCI update**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DCI decoding | PDSCH decoding | HARQ-ACK feedback(based on PDSCH decoding) | Actual result of beam indication | There will be ambiguous at network side on UE’s decoding result of DCI  |
| Success | Success | ACK | Success | Success |
| Success | Failed | **NACK** | **Success** | **Unknown** |
| Failed | Failed | **NACK** | **Failed** |

So we think this should be clarified, especially in case of HARQ-ACK multiplexing, which is a typical use case for HARQ-ACK feedback. And we propose to consider HARQ-ACK multiplexing to determine a unified solution. **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* **FFS which one of indicated TCI states to be updated in case of HARQ-ACK multiplexing**
	+ **For example, the TCI state(s) indicated in DCI corresponding to last position with ACK value in the HARQ-ACK codebook**
 |
| Xiaomi | Support the Proposal 3.D from NEC. |
| Huawei, HiSilicon | **Proposal 3.B:** Support.**Issue 3.3:** OK with max 2 per band.**Proposal 3.E:** Support.**Proposal 3.B.1:** Support. |
| MediaTek | **Proposal 3.B**: This proposal doesn't prevent Alt2. Note that we already have an agreement as follows:**Agreement** On Rel-17 DCI-based beam indication, regarding application time of the beam indication for CA, the first slot and the Y symbols are both determined on the carrier with the smallest SCS among the carrier(s) applying the beam indication. * For Rel-17 MAC-CE based beam indication (when only a single TCI codepoint is activated) and activation, it follows the Rel-16 application timeline of MAC-CE activation
	+ How to capture this in the specifications is up to the editors

This agreement does not only valid for CCs with common TCI state ID update, it is general for CA operation. If the BAT is configured per CC, then based on above agreement, what’s the difference between Alt1 and Alt2? |
| Ericsson | **Proposal 3.D:** Legacy is 2 per cell group:CellGroupConfig ::= SEQUENCE { cellGroupId CellGroupId, rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLC-ID)) OF RLC-BearerConfig OPTIONAL, -- Need N rlc-BearerToReleaseList SEQUENCE (SIZE(1..maxLC-ID)) OF LogicalChannelIdentity OPTIONAL, -- Need N mac-CellGroupConfig MAC-CellGroupConfig OPTIONAL, -- Need M physicalCellGroupConfig PhysicalCellGroupConfig OPTIONAL, -- Need M spCellConfig SpCellConfig OPTIONAL, -- Need M sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig OPTIONAL, -- Need N sCellToReleaseList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellIndex OPTIONAL, -- Need N ..., [[ reportUplinkTxDirectCurrent ENUMERATED {true} OPTIONAL -- Cond BWP-Reconfig ]], [[ bap-Address-r16 BIT STRING (SIZE (10)) OPTIONAL, -- Need M bh-RLC-ChannelToAddModList-r16 SEQUENCE (SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelConfig-r16 OPTIONAL, -- Need N bh-RLC-ChannelToReleaseList-r16 SEQUENCE (SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelID-r16 OPTIONAL, -- Need N f1c-TransferPath-r16 ENUMERATED {lte, nr, both} OPTIONAL, -- Need M simultaneousTCI-UpdateList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R simultaneousTCI-UpdateList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R simultaneousSpatial-UpdatedList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R simultaneousSpatial-UpdatedList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R uplinkTxSwitchingOption-r16 ENUMERATED {switchedUL, dualUL} OPTIONAL, -- Need R uplinkTxSwitchingPowerBoosting-r16 ENUMERATED {enabled} OPTIONAL -- Need R ]], [[ reportUplinkTxDirectCurrentTwoCarrier-r16 ENUMERATED {true} OPTIONAL -- Need N ]]}Proposal 3.B.1: Although RAN2 makes the final decision, we think it is OK to make this agreement.  |
| Lenovo | Proposal 3.B:We are OK with it for the sake of making progress.Proposal 3.D: SupportProposal 3.E: Support |

### Issue 4 (MP-UE)

Table 7 Summary: issue 4

|  |  |  |
| --- | --- | --- |
| **#** | **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
* 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]. There is no consensus in resolving the FFS. Hence it is removed in order not to hold off progress. This issue needs conclusion in this meeting. This proposal will be moved to EMAIL ENDORSEMENT 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}

**FL Note:** Discussed offline [1]. Spec impact is unclear. This issue will be suspended from discussion in the next round. | **Support/fine**: MTK, Apple, 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), IDC, Nokia/NSB |
| 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]. This proposal will be moved to EMAIL ENDORSEMENT 1**ENDORSED. DISCUSSION IS CLOSED** | **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 | 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**Proposed conclusion 4.D**: On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, there is no consensus in supporting indication of DL-only panel using one value of the max supported number of SRS ports **FL Note:** Discussed offline [1]. This proposal will be moved to EMAIL ENDORSEMENT 1**ENDORSED. DISCUSSION IS CLOSED** | **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]. This proposal will be moved to EMAIL ENDORSEMENT 1**ENDORSED. DISCUSSION IS CLOSED** | **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.

**FL Note:** Discussed offline [1]. If there is no consensus, Alt-4 becomes the default outcome. Need to **conclude** this meeting.  | **Alt1**: MTK, Nokia/NSB, Samsung, ZTE, IDC, LG, Lenovo/MotM**Alt2**: OPPO, CMCC, Intel, Apple **Alt3**: OPPO, CMCC, Intel, Apple **Alt4**: Ericsson, CATT, Spreadtrum, Huawei/HiSi |
| 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.
* 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]. Removed Alt3 since no company is supporting  | **Alt1**: Nokia/NSB, vivo**Alt2**: Qualcomm, NTT Docomo, NEC, LG, Samsung, OPPO (only when no ACK mechanism), CMCC, IDC, ZTE, Lenovo/MotM, Spreadtrum, Huawei/HiSi**Not support:** Apple, Ericsson, MTK, CATT, Intel  |
| 4.8 | **Proposal 4.H:** On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, for the agreed reporting of UE capability value set, introduce 'cri-RSRP-SetIndex', 'ssb-Index-RSRP-SetIndex', 'cri-SINR-SetIndex','ssb-Index-SINR-SetIndex' for *reportQuantity* in a CSI reporting setting.**FL Note:** Proposed by MediaTek during EMAIL ENDORSEMENT 1 | **Support/fine:** MTK, ZTE, Samsung, NEC**Not support:** Ericsson |
|  |  |  |

Table 8 Additional inputs: issue 4

|  |  |
| --- | --- |
| **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 caseFor Proposal 4.B, no spec impact is needed. It should be common senseFor Proposal 4.C, supportFor Proposal 4.D, supportFor Proposal 4.E, supportFor Proposal 4.F, support Alt5.For Proposal 4.G, support Alt2 |
| Mod V05 | **Revised some proposals to reduce alternatives.** **Proposals 4.A, C, D, and E will be moved to EMAIL ENDORSEMENT 1** |
| NTT Docomo | For Proposal 4.A, we slightly prefer not to support the identical values. But OK to go with majority view.For Proposal 4.C, supportFor Proposal 4.D, supportFor Proposal 4.E, support For Proposal 4.G, support Alt2 |
| LG | 4.B: It seems that there is a concern on spec impact. If this is common understanding, we can agree on this as a ‘conclusion’.4.F: support both Alt-1 and Alt-5. When UE panel is updated, it is more likely for NW to update TCI accordingly. In this case, Alt-1 can be used as ACK. But there is other case that same CRI/SSBRI is preferred for multiple UE panels. In this case, Alt-5 can be used as ACK. This operation may or may not have spec impact, which can be discussed later after converging on the alt(s). |
| Xiaomi | Proposal 4.D: If there is a SSBRI/CRI measured by a DL-only panel included in the beam report, what value of the max supported number of SRS ports will be indicated for it? |
| ZTE | 4.4: We agree DL-only panel should be taken into account in the report. But we still have some concerns on using max supported number of ports as 0 to indicate DL-only panel. It is because that, it is not good for extension for forward compatibility, and the capability set may include more features besides for max # of SRS port in the future.**The correspondence is better to be indicated between an index of capability value set and a reported report the CRI/SSBRI**, instead of only association between max number port (only one feature) and a reported report the CRI/SSBRI.An index 0 of UE capability value set is reserved for this enhanced beam report procedure. Therefore, UE does not need to report the content for UE capability value set with index 0 for UE capability report, and alternatively we can consider ‘0’ as a reserved ID to indicate DL-only panel.4.6: Support Alt-1 with removing the brackets. TCI state update cannot be used as response directly, but can be used with some enhancements. Alt2 may need a dedicated SS, we don’t think this response deserves a dedicated SS. 4.7: Support Alt2 |
| InterDigital | Our views are added in the table. |
| Nokia | 4.1: Fine with Proposal 4.A4.2: No need to discuss4.3: Support Proposal 4.C4.4: Support conclusion.4.5: Support Proposal 4.E4.6: Support Alt-1. Mechanism is needed to keep gNB and UE aligned with the correspondence. |
| Lenovo | 4.1: It is not clear if a value set can be multiple indices. If different value sets must have different values, a value set represent a type of UL panel. For UE with multiple, identical panels, multiple indices are required.4.2: Support Proposal 4.B4.3: Support Proposal 4.C provided more than one indices are allowed for a value set.4.5: Support Proposal 4.E.Proposal 4.F: We support Alt.1Proposal 4.G: Regarding Alt.2, we do not think different SRS resource set must have different number of ports. We support Alt.2 provided this condition is removed. We propose the new wording as follows:* 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.
 |
| OPPO | 4.1: prefer to include identical value. But if the majority ok with not including, we can live with it.4.4 Proposed conclusion 4D: support to make the conclusion.4.E: support |
| Intel | **Proposal 4.F:** ACK is needed. Alt-1 works only if we agree that UE does not switch panel types before the TCI activation is received. Something like this has not been captured in spec before and we are not sure how it can be captured since we do not define panel or panel type. Therefore, if UE is free to switch panel types autonomously, then there will be misalignment between gNB and UE on panel parameters. **Proposal 4.G:** If we agree on any type of ACK mechanism, then this is not needed.  |
| Mod V19 | **No revision on proposals except brackets on 4.G per Lenovo****Added 4.8 (proposal 4.H) per MTK comment** |
| vivo | **Proposal 4.F**: Support Alt4. It is not necessary to define new acknowledgement mechanism for beam report in Rel-17. The UL panel selection with different supported number of ports can be realized through BWP switching, regardless of whether the beam report including the correspondence is lost. If the gNB is ready to schedule UL transmission with a specific port #, target BWP needs to be switched firstly for a target panel selection. If the new beam report is lost, the indicated TCI state is based on the old beam report. The subsequent triggered SRS and scheduled PUSCH with the specific port # on the target panel are based on the old optimal SSBRI/CRI. Similar to legacy gNB implementation, for example, when the gNB detects the deterioration of uplink performance, the gNB can re-trigger the beam report to update the correspondence between index and SSBRI/CRI.**Proposal 4.G**: Alt1 has no specification impact. We are also fine to drop the proposal. From Alt1 perspective, it is just reusing the UL BWP switching mechanism, where each BWP is configured with different SRS port #. The FFS part of Alt1 can be deleted.**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. |
| NEC | **4.6. Proposal 4.F:** From the perspective of protecting beam report, ACK is not needed. If we are talking about UE panel assumption, it is better to be explicitly reflected in proposals.In our understanding, Alt 1 means UE can only switch to reported panel if indicated TCI state contains reported RS. If indicated TCI state contains NO reported RS, UE cannot use reported panel. It is up to NW whether to indicate TCI state contains reported RS. If this is the case, it cannot be called as an ‘acknowledgement’, it is just a regular operation that UE can only act upon NW’s indication.In addition, there may be different interpretations on UE panel assumption for Alt 4, one is that UE can switch to reported panel right after correspondence reporting, the other is UE cannot switch to the reported panel unless NW indicates a TCI state contains reported RS (which is then basically the same as what Alt1 says).**Therefore, we are open to have either Alt1 or Alt4, if clear and explicit UE panel assumption can be reflected in proposals, for example,*** **Alt-1: add ‘reported capability value [set] is applied after receiving activated TCI state includes reported RS’**
* **Alt-4: add ‘reported capability value [set] is applied after reporting’**

**4.8. Proposal 4.H:** Support. |
| ZTE2 | **Proposal 4.F:** Regarding vivo’s response, from gNB perspective, we can NOT agree with that. The uplink performance loss is a serious issue and may be introduced by many issues. Normally, the gNB will reduce the MCS or RANK or increase Tx power for link adaptation. If the UE can automatically change its capability but gNB can not be aware of this, the network operation will be disruptive.**Proposal 4.H:** We can support this proposal. Alternatively, we may only need to introduce a new parameter to enable this UE capability value set report, like Rel-17 parameter *groupBasedBeamReporting-r17*. From spec perspective, the latter may have minor RAN1 spec impact, if our motivation is just to reuse what we have in the current spec for L1-RSRP/SINR-beam reporting as much as possible.  |
| CMCC | **Proposal 4.F:** We think ACK mechanism is needed to avoid misunderstanding between NW and UE. Our first preference is Alt2/3, and can also accept Alt 1.**Proposal 4.G:** Support Alt2.**Proposal 4.H:** Support. ZTE’s suggestion is also fine to us. |
| Huawei, HiSilicon | **Proposal 4.H:** Support. |
| Ericsson | **Proposal 4.F:** Discussion “ack” feels pointless: what would be the result of the ACK? Would this mandate any NW behaviour?**Proposal 4.H:** In line with the recent agreement, where “set” is now in brackets, we cannot use the name “set”. Using “capability” is far more descriptive. Also, using the RRC IE name is clearer. We propose**Proposal 4.H.1:** On Rel.17 enhancements to facilitate UE-initiated panel activation and selection, for the agreed reporting of UE capability value [set], introduce 'cri-RSRP-capabilityIndex', 'ssb-Index-RSRP-capabilityIndex', 'cri-SINR-capabilityIndex','ssb-Index-SINR-capabilityIndex' for *reportQuantity* in a CSI-ReportConfig.  |
| Nokia | **4.7:** Same view as Intel – if ACK mechanism is agreed in 4.6, there is no need for 4.7 (kind of ACK mechanism variants). |

### Issue 5 (MPE)

Table 9 Summary: issue 5

|  |  |  |
| --- | --- | --- |
| **#** | **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), NTT Docomo, CATT, IDC, Ericsson |
| 5.2 | The Rel-17 P-MPR report is 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, NTT Docomo, ZTE, OPPO (discuss)**Not support**: vivo (change beam to panel), ZTE (already supported), Samsung, Qualcomm, LG (change beam to panel), Huawei/HiSi (RAN2/4), CATT, Ericsson (follow legacy) |
| 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, NTT Docomo, CATT, IDC, OPPO, Ericsson |
| 5.4 | 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, NTT Docomo, CATT, IDC, OPPO, ERicsson |
| 5.5 | For the enhanced reporting for MPE mitigation, support N value sets where each set has (Pcmax, PHR, P-MPR, SSBRI/CRI) | **Support/fine**: LG**Not support**: Ericsson (not essential) |

Table 10 Additional inputs: issue 5

|  |  |
| --- | --- |
| **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** |
| Mod V05 | **Revised proposal in 5.2 per Apple**  |
| LG | 5.1: As mentioned in round 0, we would like to know the difference to the agreement on a resource pool for MPE reporting with considering some kind of association.We sympathize with Docomo and vivo that the index of corresponding UE capability value set should be reported along with SSBRI/CRI in PHR MAC CE for MP-UE.Based on Mod’s comment ‘will include in round 1’ in the previous round, the corresponding proposal is copied as below.For the enhanced PHR reporting, the issue on reporting Pcmax has not been discussed in detail. The current agreement for MPE mitigation via PHR MAC CE is only to extend N P-MPR (MPE) and the corresponding SSBRI/CRI, but not to be extended for a single pair of Pcmax/PHR as in TS38.321. To our understanding, the purpose of the enhanced PHR reporting is mainly for MPUE where each panel can have different preferred beam (i.e. SSBRI/CRI) and different P-MPR considering the difference of the MPE event on the panels. Hence, it is better to report Pcmax and PHR for each panel together with the agreed N pairs of {P-MPR, SSBRI/CRI} since each panel can have different max power (e.g. 20dBm/23dBm) and/or different PHR. It would be straight-forward for MAC CE design and it also gives the full functionality of panel-specific UL transmission.Thus, we would like to propose the following:**Proposal: For the enhanced reporting for MPE mitigation, support N value sets where each set has (Pcmax, PHR, P-MPR, SSBRI/CRI)** |
| Xiaomi | For 5.4, we suggest to update the proposal as follows:Proposal 5.4: for P-MPR value and presence of SSBRI/CRI in N pair, down-select the following alternatives:* Alt.1: the P-MPR value in only one of N pairs is larger or equal to mpe-Threshold without presence of SSBRI/CRI.
* Alt.2: the P-MPR value in each of N pairs is lower than mpe-Threshold with presence of SSBRI/CRI.

Note: Alt 2 means that the previous agreement need to be revised to ‘For each P-MPR value, ~~up to M~~ 1 SSBRI~~(s)~~/CRI~~(s)~~, where the SSBRI~~(s)~~/CRI~~(s)~~ is selected by the UE from a candidate SSB/CSI-RS resource pool’.[Mod: Given that this is a maintenance phase, Alt2 is not feasible unless there is consensus. Since the proposal doesn’t seem to receive ample support, adding more alternatives doesn’t seem helpful for improving acceptability] |
| ZTE | 5.1: No need to report panel information besides beam information (SSBRI/CRI)5.2: Reasonable, open to discuss it. 5.3: OK5.4: Not clear.  |
| CATT | 5.3: In the legacy PHR reporting, the cell associated with the reported PCMAX, PH and P-MPR parameters have been reported. It seems not necessary to add the restriction. 5.4: Similar to the candidate beam reporting in Scell BFR, UE will let gNB know that no candidate beam is found if the UE can’t find a candidate beam, there is no restriction on the maximum number of this reporting. |
| InterDigital | Our views are added in the table. |
| OPPO | 5.1: The proposal is not clear. In our view, the UE shall also report L1-RSRP for a CRI with P-MPR reporting.On Rel-17 enhancements to facilitate MPE mitigation, the UE shall also report L1-RSRP measurement for the SSB/CSI-RS resources ~~set associated~~ with P-MPR reporting ~~should be also associated with L1-RSRP/SINR reporting~~5.2: support to discuss this issue.5.3: it is not needed. The similar proposal has been discussed many times during the discussion on MPE issue. We do not want to re-open the same discussion again.5.4: The proposal is not clear. How can a UE limit the max number of P-MPR value larger than some threshold? The P-MPR is obtained through measurements and no one can control the number of measured P-MPR values being larger than threshold.  |
| Mod V19 | **Added issue 5.5 per LG****Issue 5.1: @proponents (MediaTek, Samsung), please check OPPO’s input if it is acceptable**  |
| ZTE2 | 5.5: We are open to have this enhancement. |
| MediaTek | In fact, we are fine with OPPO’s change. However, we believe any additional report quantity is precluded during RAN1#106b meeting as follows:**Agreement**On Rel.17 enhancements to facilitate MPE mitigation, confirm the following working assumption (in the midst of the previous agreement) as an agreement with the following refinement (highlighted in red):

|  |
| --- |
| On Rel.17 enhancements to facilitate MPE mitigation, support the following enhancement on the Rel-16 event-triggered P-MPR-based reporting (included in the PHR report when a threshold is reached, reported via MAC-CE):* In addition to the existing field in the PHR MAC-CE, N≥1 P-MPR values can be reported
	+ The N P-MPR values are reported together with the following:
		- ~~(Working Assumption)~~ For each P-MPR value, up to M SSBRI(s)/CRI(s), where the SSBRI(s)/CRI(s) is selected by the UE from a candidate SSB/CSI-RS resource pool (FFS: how to perform the selection)
			* Support M=1
			* ~~FFS: The supported value(s) of M~~
* ~~FFS: Additional reporting quantities, e.g. SSBRI/CRI, MPR+DL RSRP, or modified virtual PHR~~
* ~~FFS: additional signaling (e.g. CSI triggering) from the NW~~
 |

Since the RS resources for MPE mitigation and BM could be different, it will be difficult for UE to determine UL beams by considering both L1-RSRP and P-MRP. Thus, we see it is beneficial to align the RS resource for MPE mitigation and BM. |
| Xiaomi | To CATT, I agree that UE need to let gNB know that no candidate beam is found if the UE can’t find a candidate beam. But if N=4, what is the motivation for UE to report 4 P-MPR values without candidate beam for any one P-MPR value? From our view, in this case, it is sufficient for UE to report only one P-MPR value without candidate beam.To OPPO, yes, the P-MPR is obtained through measurements. If the P-MPR is larger than mpe-Threshold, it will be no candidate beam for this P-MPR value. Our intention is to limit the number of P-MPR value without candidate beam in the report. It is not necessary to report more than one P-MPR value without candidate beam for signaling overhead reduction.  |

# References