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| R1-2104202 | Beam management for simultaneous multi-TRP transmission with multi-panel reception | FUTUREWEI |
| Proposal 1: Different beams reported by the UE that can be received simultaneously should be associated with different TRPs.  Proposal 2: For beam measurement/reporting enhancement to facilitate inter-TRP beam pairing, in a single CSI-report, UE can report N={1, 2, 3, 4) pairs/groups and M (M=2) beams per pair/group, and different beams within a pair/group can be received simultaneously and are associated with different TRPs. The value of N is fixed by RRC configuration.  Proposal 3: On CMR resource configuration for beam reporting option 2, adopt “set”. Each reported beam pair in a single CSI -report consists of M = 2 SSBRI/CRI values, where each SSBRI /CRI points to a CMR resource in a different CMR resource set, and where each CMR resource set is associated with a different TRP.  Proposal 4: FeMIMO supports adding TRP identification (e.g., groupID) to TCI state for beam measurement/reporting enhancement to facilitate inter-TRP beam pairing.  Proposal 5: FeMIMO supports BFD-RS are QCLed with PDCCH DMRS with respect to 'QCL-TypeD' assuming that the Rel-17 unified TCI framework supports M>1 DL TCIs such that each of the TCI provides QCL information for UE-dedicated reception on a subset of CORESETs in a CC. | | |
| R1-2104268 | Discussion on Multi-panel reception for multi-TRP in Rel-17 | Huawei, HiSilicon |
| Proposal 1: Support reporting up to N = 4 beam pairs in a single report, where the value of N is configured by gNB.  Proposal 2: Support configuring measurement resources of one TRP in one resource set.  Proposal 3: Mutual interference between the reported beams should be considered for L1-SINR calculation in group-based beam reporting.  Proposal 4: Support Option 3 (different beams in different CSI-reports can be received simultaneously) especially for non-ideal backhaul cases.  Proposal 5: The number of BFD-RS in one BFD-RS set is up to 2.  Proposal 6: Support selecting the PUCCH-SR resource associated with the other/non-failed BFD-RS set for BFRQ transmission.  Proposal 7: Support reporting index of BFD-RS set with beam failure explicitly in BFR MAC CE.  Proposal 8: For SpCell configured with two BFD-RS sets,   * if beam failure is detected in only one BFD-RS set, the UE shall report one new beam or indication of no new beam identified for that BFD-RS set via R17 MAC CE; * if beam failure is detected in both BFD-RS sets and a new beam is identified from any of configured NBI-RS sets, the UE should fallback to RACH based BFR procedure if configured.   Proposal 9: For SCell configured with two BFD-RS sets,   * if beam failure is detected in only one BFD-RS set, the UE shall report one new beam or indication of no new beam identified for that BFD-RS set via R17 MAC; * if beam failure is detected in both BFD-RS sets, UE shall report one new beam or indication of no new beam identified for each BFD-RS set via R17 MAC CE. | | |
| R1-2104294 | Further Discussion on M-TRP Beam Management | InterDigital, Inc. |
| Observation 1: A large N supports a better scheduling flexibility for a network, however at the same time it may increase CSI overhead as well as UE complexity.  Observation 2: In a network, the number of suitable pairs may dynamically change, and it may not always as large as Nmax.  Observation 3: In Rel-16, the maximum number of BFD-RS per set is fixed in the specification.  Observation 4: Per-TRP BFR operation should not require involvement of another TRP, and a BFD event should be entirely managed independently by each TRP.  Observation 5: BFR at both TRP is a severe beam failure case that needs to be considered.  Proposal 1: Support maximum value based on Alt2 that is N = {1, 2, 3, 4} where Ncap, the maximum value of N, is determined based on UE capability.  Proposal 2: Support Alt2: The value of N is upper bounded by a maximum value Nmax configured by RRC, and dynamically selected/indicated by UE.  Proposal 3: On the number of BFD-RS per BFD-RS set, support Alt1: max value is 2.  Proposal 4: Support Alt-2: PUCCH-SR resource associated with failed BFD-RS set.  Proposal 5: If beam failure is detected at both TRP simultaneously, the BFR associated to TRP1 or PCell should be prioritized. | | |
| [R1-2104345](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104345.zip) | Further discussion on MTRP multibeam enhancement | vivo |
| 1. Option 3 provides the highest Scheduling flexibility with the same UCI payload size per PUCCH/PUSCH resource for non-ideal backhaul scenarios. 2. For non-ideal backhaul cases, some throughput gain can be achieved by Option 3, while outdated beam pair applied due to backhaul delay for Option 1 and Option 2 when forwarding the beam report from one TRP to the other TRP. 3. For MTRP, performance loss is observed for L1-SINR-based beam pair report with interference calculated between the reported beam pair. 4. Rel-17 MTRP beam reporting enhancement should take into account both ideal backhaul and non-ideal backhaul scenarios to support simultaneous transmission at the network side and simultaneous reception at the UE side. 5. For the value of N,    * Support selecting one value in Alt1 as the maximum value of N based on UE capability, i.e., support maximum value N = {1, 2} as a UE capability.    * Support Alt2 to determine the number of reported beam pair(s) in a single CSI report, i.e., the value of N is upper bounded by a maximum value Nmax configured by RRC, and dynamically selected/indicated by UE. 6. Support reuse resource configuration of MTRP CSI, i.e., two subsets configured in a CSI-RS resource set, each corresponding to one TRP. 7. Support the bitwidth of one SSBRI/CRI in one beam pair be determined based on the number of SSB/CSI-RS resources from the associated set/subset, while the other one be determined based on the number of SSB/CSI-RS resources across sets/subsets. 8. Support that the reported beam pairs can be received simultaneously by the same spatial filter or different spatial filters.    * an indication of whether reported beams are associated with different spatial filters can be considered in beam report. 9. To facilitate scheduling flexibility, consider to support L1-RSRP report in one CSI report with two different hypotheses: one pair of beams that are suitable for MTRP operation, and another beam(s) for STRP operation. 10. Support Option 3 for multi-TRP beam report enhancement in non-ideal backhaul scenarios. 11. Do not support L1-SINR report with interference calculated between the reported beam pair. 12. Support a unified design of TRP-specific BFR for S-DCI and M-DCI. 13. TRP-specific BFR procedure should be discussed before considering simultaneous configuration of cell-specific BFR and TRP-specific BFR cases. 14. For TRP-specific BFD-RS configuration,     * Two sets of BFD-RS can be explicitly configured for both multi-DCI-based MTRP and single-DCI-based MTRP.     * Two sets of BFD-RS can be implicitly configured for multi-DCI-based MTRP, each including P-CSI-RS indexes with QCL-typeD for PDCCH monitoring associating with one of the two values of CORESETPoolIndex.     * Support to report the maximum number of RS per BFD-RS set as UE capability. 15. Support the case of optionally configuring TRP specific NBI-RS   When no TRP-specific NBI-RS resource is configured for the UE, support triggering an aperiodic CSI report to obtain new beam(s).  Further study the case of whether UE can select the beams from the NBI-RS set not associated with the failed TRP.   1. For the 1-to-1 association between each NBI-RS set and a BFD-RS set    * The association only exists when two NBI-RS sets are configured.    * The association can be indicated by BFD-RS set ID or CORESETPoolindex. 2. For the dedicated PUCCH-SR resources for TRP-specific BFRQ,   For the case when two PUCCH-SR resources are configured for TRP specific BFRQ in a cell group,   * + Two PUCCH-SR resources are under different SR configurations respectively.   + Each PUCCH-SR resource associated with a BFD-RS set of one TRP can be configured with the spatial filter towards the other TRP in FR2. * For the case when one PUCCH-SR resource is configured for TRP specific BFRQ in a cell group,   + The PUCCH-SR resource can be associated with one or two spatial relations.     - The case of two spatial relations is used as agreed for PUCCH repetition.  1. For TRP-specific BFRQ,  * For the case of BFR of one TRP,   + When one TRP fails in a cell where two PUCCH-SR resources are configured, any one of Alt1 and Alt2 can be used to select one PUCCH-SR resource to be transmitted.   + When one TRP fails in a cell, while no TRP fails in another cell where two PUCCH-SR resources are configured, the PUCCH-SR resource selected to be transmitted is up to UE implementation.   + When more than one UL grants are available to transmit BFR MAC CE, the selection rule should also be considered. * For the case of BFR of both TRPs in SpCell or SCell, it needs to be further studied.  1. Following information can be provided in BFR MAC CE based on configuration   Index of the BFD-RS set associated with the failed TRP  CC index (if applicable)  New candidate beam index(es) (if found) if NBI-RS(s) is configured for the failed TRP  Indication whether new beam(s) is found if NBI-RS(s) is configured for the failed TRP   1. Support to deactivate TRP through MAC CE if there is no new beam found. 2. For the case of BFR of one TRP, a UE can receive the following signaling as BFRR in addition to legacy BFRR:   a MAC CE activation command to update the TCI states for the CORESET(s) related to the TRP/BFD-RS set in beam failure.  a MAC CE deactivation command to de-activate the failed TRP so that to achieve the switch of transmission hypothesis from MTRP to STRP.  a PDCCH to trigger a beam measurement and reporting procedure for the failed TRP.   1. For a UE operating with multi-DCI-based MTRP,   For the case of BFR of one TRP, if it has reported the new beam,   * + UE may reset the beam to the new beam for the PDCCH and PDSCH associating with the CORESETPoolIndex which has been declared beam failure.   + UE may reset the beam according to the beam indication in the MAC CE when BFRR is a MAC CE activation command to update the TCI states.   For the case of BFR of one TRP but no new beam has been found and reported, UE does not reset the beam.   * + UE may fall back to single TRP reception when BFRR is a MAC CE deactivation command for the failed TRP.   + UE may perform an aperiodic beam training and report new beam(s) to the network when receiving a PDCCH including the filed of CSI request.   For the case of both TRPs in beam failure and only a single new beam, the UE may fall back to single TRP reception when receiving a MAC CE deactivation command or RRC reconfiguration command.   1. For a UE operating with single-DCI-based MTRP, if it has reported the new beam, UE does not reset the beam   For this case, BFRR is a MAC CE activation command to update the TCI states for the CORESET(s) related to the TRP/BFD-RS set in beam failure. | | |
| [R1-2104406](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104406.zip) | Enhancements on beam management for multi-TRP | Lenovo, Motorola Mobility |
| Proposal 1: Support maximum value N = {1, 2, 3, 4} for beam reporting option 2.  Proposal 2: To support multi-DCI based multi-TRP DL transmission, UE can report two groups and M>=2 beams per group in a CSI-report. Different beams in different  groups can be received simultaneously.  Proposal 3: The agreed Option 2 achieved in RAN1#104 for LI-RSRP also applies for L1-SINR.  Proposal 4: Include inter-TRP interference in L1-SINR in group based beam reporting.  Proposal 5: Two CMR resource sets can be configured in the resource setting for channel measurement, and the bitwidth of each SSBRI/CRI is determined based on the number of SSB/CSI-RS resources from the associated set.  Proposal 6 : For PUCCH-SR resource selection when 2 PUCCH-SR resources are configured, support :   * Alt-3 when the cell configured with 2 PUCCH-SR resources is not configured with TRP-specific BFR or both TRPs in the cell are not failed if TRP-specific BFR is configured in the cell or both TRPs in the cell are failed if TRP-specific BFR is configured in the cell. * Alt-1 or Alt-2 when the cell configured with 2 PUCCH-SR resources is configured with TRP-specific BFR and only one TRP is failed.   Proposal 7: Select Alt-1 out of Alt-1 and Alt-2 when one SR configuration is configured with 2 PUCCH-SR resources.  Proposal 8: Select Alt-2 out of Alt-1 and Alt-2 when two SR configurations are configured with one PUCCH-SR resource per SR configuration.  Proposal 9: The priority of positive LRR of TRP-specific BFR is higher than positive SR.  Proposal 10: Further study the priority of positive LRR of TRP-specific BFR and positive LRR of SCell BFR considering whether PCell/PScell is configured with TRP-specific BFR.  Proposal 11: When multi-TRP operation and multiple BFD-RS sets are configured in a cell, two bits can be contained in the cell bitmap for this cell in the BFR MAC CE, where each bit is used to indicate where beam failure is detected on the corresponding TRP in the carrier.  Proposal 12: Study how to make sure that the PUSCH for carrying MAC CE is not transmitted to the TRP who has been failed.  Proposal 13: At least support simultaneous configuration of TRP-specific BFR and cell-specific BFR for PCell/PScell.  Proposal 14: Increase the number of SRS resource set configured for antenna switching to obtain the channel information between each TRP of multiple TRPs and a UE.  Proposal 15: Further study simultaneously receiving PDCCH+PDCCH and simultaneously receiving CSI-RS+CSI-RS with different QCL-TypeD for multi-panel UE if time is available. | | |
| R1-2104413 | Discussion on enhancements on beam management for multi-TRP | Spreadtrum Communications |
| Observation 1: It is not necessary to configure both cell-specific and TRP-specific BFR.  Proposal 1: For option 2, regarding CMR configuration, support   * Two CMR resource sets can be configured per periodic/semi-persistent CMR resource setting * Two CMR resource sets can be simultaneously triggered per aperiodic CMR resource setting   Proposal 2: For N, not support the value larger than 2.  Proposal 3: Different beams in the same pair/group can be received simultaneously by the UE either with a single spatial domain receive filter, or with multiple simultaneous spatial domain receive filters.  Proposal 4: For L1-SINR based beam measurement in support of M-TRP simultaneous transmission, support a single CSI-report consisting of N beams pairs/groups and M (M>1) beams per pair/group, and different beams within a pair/group can be received simultaneously.   * M = 2 * N=1 and N=2   Proposal 5: For the maximum number of RS per BFD-RS set, it is based on UE’s capability, and the candidate values at least include 1, and 2.  Proposal 6: For TRP specific BFR, at least explicit BFD-RS set configuration could be supported.  Proposal 7: For TRP specific BFR, not support one PUCCH-SR resource configured with 2 spatial relations.  Proposal 8: For TRP specific BFR, for a UE configured with two PUCCH-SR resources in a cell group, when SR is triggered for beam failure procedure, it is up to UE’s implementation to select the PUCCH-SR resource.  Propose 9: Support R17 BFRQ MAC CE to convey cell level beam failure event.  Proposal 10: Support to enhance on PDCCH reception for multi-DCI based multi-TRP case.  Proposal 11: In overlapping PDCCH monitoring occasions in multiple CORESETs that have same or different QCL-TypeD properties on active DL BWP(s) from different TRPs, priority rule of monitoring in Rel-15 should be applied separately for each TRP.  Proposal 12: Support to enhance on DL SPS PDSCH reception for multi-DCI based multi-TRP case.  Proposal 13: In overlapping PDSCH without corresponding PDCCH transmissions receiving occasions from multiple TRP, one PDSCH with lowest configured sps-ConfigIndex for each TRP could be received.  Proposal 14: PDSCH without corresponding PDCCH transmission associates with the same value of CORESETPoolIndex as CORESET where PDCCH activating the PDSCH lies in. | | |
| R1-2104486 | Beam management enhancements for multi-TRP | CATT |
| Proposal 1: Option 3 can be supported additionally.   * Association between different CSI-reports can be established through triggering PDCCHs or RRC signaling.   Proposal 2: For option 2, a CSI-report is associated to one CMR resource set, which comprises two subsets.  Proposal 3: Bitwidth of each SSBRI/CRI is determined based on the number of SSB/CSI-RS resources from the associated subset.  Proposal 4: In Option 2,   * On the maximum number of beam pairs/groups (N), Alt1 is supported.   + Alt1: Support maximum value N = {1, 2}. * On the number of beam pairs/groups (N) reported in a single CSI-report, Alt1 is supported. We would be open to Alt2 on the condition that a UE supporting Alt2 must be mandated to also support Alt1.   + Alt1: The value of N is fixed by RRC configuration.   + Alt2: The value of N is upper bounded by a maximum value Nmax configured by RRC, and dynamically selected/indicated by UE.   Proposal 5: Support L1-SINR based beam reporting for option 2.  Proposal 6: For option 2, only CMR is configured, while for each beam index (e.g. CRI1), the other reported beam index points to the interference resource.  Proposal 7: On the maximum number of RS per BFD-RS set, Alt2 is preferred.   * Alt2: max value is a UE capability, including possible candidate value of 1.   Proposal 8: A CC operating with “cell-specific BFR” can have at most one BFD-RS set.  Proposal 9: A UE is configured with either “cell-specific” BFR (i.e., 1 BFD-RS set) or “TRP-specific BFR” (i.e. 2 BFD-RS sets) on one CC.  Proposal 10: Define an identifier to differentiate TRPs in M-TRP beam failure recovery.  Proposal 11: A failed TRP is identified by the index of the BFD-RS set in which beam failure is detected.  Proposal 12: Support either explicit or implicit BFD-RS configuration.  Proposal 13: If implicit BFD RS determination is adopted, CORESETs are divided in two separate groups, where implicit BFD RS determination is performed in each group based on existing Rel.16 rule. This applies to both S-DCI and M-DCI.  Proposal 14: If explicit BFD RS configuration is supported, MAC-CE based BFD RS (set) updating method should be considered to update BFD RS.  Proposal 15: Support the configuration of two PUCCH-SR, where each PUCCH-SR can be configured with a single UL spatial filter.  Proposal 16: When two PUCCH-SR resources are configured, each PUCCH-SR k (k=0, 1) is associated with one BFD-RS set (k=0, 1) in all CCs in the cell group (i.e. Alt-2).   * When beam failure is detected in one BFD-RS set k (k = 0 or 1) in any CC in the cell group, PUCCH-SR k is selected for LRR transmission.   + NOTE: The UL spatial filter of PUCCH-SR k can be pre-configured/optimized pointing to TRP associated with the other BFD-RS set s, k!=s. This is gNB implementation and requires no spec support. * When beam failure is detected in more than one BFD-RS set in more than one CC in the cell group, either one or two PUCCH-SR resources can be selected.   + The details are FFS.   Proposal 17: Support the event of a single or both TRP failure on SCell, and the case of a single TRP fail on SpCell. For the event of both TRP fail on SpCell, RA-based mechanism is utilized.  Proposal 18: BFR MAC-CE conveys the following information，   * BFD-RS set index(es) in which beam failure is detected. * New beam index (if found) for each failed BFD-RS set. * Whether new candidate beam is found.   Proposal 19: If BFR occurs in one BFD-RS set, only PDCCH (CORESETs) or PUCCH (resources) associated with the BFD-RS set are overwritten by the new candidate beam.  Proposal 20: CBRA-based transmission can be triggered on a SpCell for scenario 1. Support at least the following scenario:   * Scenario 1: When beam failure is detected on all BFD-RS sets on the SpCell.   Proposal 21: Only CBRA is considered for Rel.17 TRP-specific BFR.  Proposal 22: Option 1 (enhancement on priority rule) can be supported. For multiplexing of PDCCH and PDCCH, PDCCH monitoring priority rule in Rel.15 can be applied within each CORESET group.  Proposal 23: Option 2 (release of scheduling restrictions) can be supported. In addition to PDSCH + SSB, combinations related to SSB or CSI-RS can also be enhanced (e.g. PDCCH + CSI-RS, SSB + CSI-RS, etc.). | | |
| R1-2104587 | Enhancements on beam management for Multi-TRP | ZTE |
| Observation 1: Considering delay tolerant information for paring gNB Tx beam and UE panel, the benefit of Option 3 (Non-group based reporting) enhanced solution(s) for multiple CSI reports is unclear for non-ideal backhaul, although the complexity of CSI configuration and reporting may be increased significantly due to associating reporting instances.  Observation 2: From the evaluation results for group based reporting, it can be observed that:   * Increasing number of beams per group for Option 1 and increasing number of groups for Option 2 can bring significantly higher performance gain to combat blockage and UE mobility, especially for cell-edge UE in dense urban, through improving system flexibility with more candidate beams. * Increasing number of groups for Option 1 and increasing number of beams per group for Option 2 can be more suitable for advanced UE with 3, 4 or more panels.   Observation 3: For one TRP, there may have multiple TRP panels sharing the same boresight and similar large scale properties, and consequently beam measurement for one out of the multiple panels (instead of each of the panels) is sufficient for supporting the subsequent CSI acquisition and data transmission.   * In such case, the overhead of measurement RS and UL reporting can be significantly saved compared with per-panel per-TRP measurement.   Proposal 1: For facilitating inter-beam interference measurement, L1-SINR reporting should be supported.   * The definition of L1-SINR should be enhanced, considering interference among CMR(s) to be reported. * The association among CMRs from different TRPs (or called as candidate CMR pairs) should be supported.   + Analogous to Rel-16, CMR+ZP-IMR and CMR+NZP-IMR can be supported besides CMR only.   Proposal 2: Support Option 1 (panel-specific reporting) for facilitating panel-specific DL and UL beam management via RSRP reporting;   * Information on grouping one or more RS(s) (e.g., beam group ID, or antenna group ID) can be reported along with RS ID(s) and RSRP/SINR in a report instance.   Proposal 3: Extension of group based beam reporting should be considered to support more Tx beams and/or more groups to be reported in Rel-17 NR-FeMIMO.   * Regarding Option 1 (panel-specific reporting), UE can be configured to report N=2 groups and M (M =1, 2, 3, 4) beams per group. * Regarding Option 2 (beam group based reporting), UE can be configured to report N (N=3, 4) groups and M=2 beams per group (Alt-2).   + Note that N (N=1, 2) groups and M=2 beams per group have been agreed for Option 2 (beam group based reporting) in RAN1#104-e   Proposal 4: For the number of beam pairs/groups (N) reported in a single CSI-report,   * The value of N is upper bounded by a maximum value Nmax configured by RRC, and dynamically selected/indicated by UE (Alt-2).   Proposal 5: For facilitating inter-TRP pairing, one CMR resource setting can be configured with multiple CMR resource sets (each of which corresponds to a TRP transparently), with a restriction/requirement for the report.   * Regarding Option 1 panel-specific reporting, all CRI(s)/SSBRI(s) to be reported in a group should correspond to the same CMR set, e.g., paring of UE panel and TRP. * Regarding Option 2 beam group based reporting, CMR resource set (rather than sub-set) corresponds to a TRP * Aperiodic CMR resource setting can be further supported, besides for periodic and semi-persistent   Proposal 6: Support TRP-specific BFD RS and NBI RS through associating CORESETPoolIndex with BFD RS and NBI RS in mDCI-mTRP.   * For BFD, explicit and implicit methods are both supported for determining BFD RS per CORESETPoolIndex   + Explicit: Two separate BFD RS sets, q\_0(s), are configured per CORESETPoolIndex, and a RS of each of q\_0(s) should be QCL-ed with a CORESET with a CORESETPoolIndex corresponding to the q\_0   + Implicit: Two separate BFD RS sets, q\_0(s), are determined according to TCI states of CORESETs per CORESETPoolIndex * For NBI, two separate NBI RS sets, q\_1(s), can be explicitly configured per CORESETPoolIndex   Proposal 7: Introduce a new MAC-CE to activate BFD RS(s) dynamically, in order to guarantee the same timeline between PDCCH beam update and explicit BFD RS configuration.  - In the MAC-CE, BFD-RS ID and corresponding CORESETPoolIndex should be included for mDCI-mTRP.  Proposal 8: When up to two dedicated PUCCH-SR resources in a cell group are configured, association between one of PUCCH-SR resource(s) and CORESETPoolIndex should be supported for mDCI-mTRP.   * If SR is triggered due to one TRP failure, PUCCH-SR resource associated with the failed TRP is transmitted.   Proposal 9: For MAC-CE for TRP-specific BFR, the TRP information, i.e., CORESETPoolIndex of a failed TRP, should be provided explicitly.   * The bitmap of serving cell indication in BFR MAC-CE should correspond to a serving cell set associated with a TRP, wherein the serving cell set includes serving cells configured with beam failure parameter for the TPP. * FFS: design of MAC-CE, e.g., a single MAC-CE for both TRPs and two separate MAC-CE for each of TRPs.   Proposal 10: The beam and power control for CORESET/PUCCH should be updated according to a reported candidate RS, only if the CORESET/PUCCH is associated with the same CORESETPoolIndex corresponding to BFD and NBI RS sets.   * CORESETPoolIndex is introduced for PUCCH configuration, in order to initialize TRP-specific CORESET and PUCCH’s beam update * Deactivating CORESET(s) associated with the same CORESETPoolIndex, if no candidate RS can be identified. * SCS determination for 28 symbols should be further studied, e.g., for per TRP.   Proposal 11: TRP-specific BFR procedure can be applied to SpCell(s) besides SCell(s).   * FFS: condition to trigger PRACH for TRP-specific BFR in an SpCell, e.g., any TRP(s) fails, all TRPs fail or just a specific TRP fails.   Proposal 12: In multi-panel reception, DL channel(s) and RS(s) can be associated with the information about antenna group(s).   * Study mechanism(s), e.g., associating CORESET group(s) or TCI state(s) with antenna group(s).   Proposal 13: In the case of multi-TRP transmission with UE multi-panel reception, at least one of the following methods should be considered when beam collision between different DL channel(s) and RS(s) occurs.   * Alt 1: UE can prioritize the reception of a DL channel or RS with higher priority. * Alt 2: UE can use a predefined beam to receive the conflicting DL channels or RSs. * Alt 3: UE can use the indicated beam and corresponding panel to receive the DL channel or RS with higher priority, and meanwhile UE can use the other active panel and a predefined beam to receive the other DL channel or RS with lower priority. * FFS: definition of beam collision between different DL channel(s) and RS(s), e.g., different QCL Type D RS(s) under the same panel. | | |
| [R1-2104601](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104601.zip) | Enhancements on beam management for multi-TRP | CMCC |
| Proposal 1: For group-based beam reporting for multi-TRP, study whether Option2 is sufficient for non-ideal backhaul.  Proposal 2: For group-based beam reporting for multi-TRP, UE could report the information of whether the reported beams are received with different panels.  Proposal 3: On CMR resource configuration for beam reporting option 2，two CMR resource sets per periodic/semi-persistent CMR resource setting.  Proposal 4: The association between each BFD-RS set and an NBI-RS set can be indicated by configuring the same index/flag in the BFD-RS and NBI-RS set.  Proposal 5: For a UE configured with two PUCCH-SR resources in a cell group, when beam failure is detected in one TRP, whether PUCCH-SR resource associated with failed or non-failed BFD-RS set should be used is depending on the spatial relation configuration of the PUCCH-SR.  Proposal 6: For BFRQ of M-TRP BFR, PUCCH-SR for SCell can also be reused.  Proposal 7: For SpCell, cell-specific and TRP-specific BFR can be configured in the same CC. | | |
| R1-2104656 | Enhancements on beam management for multi-TRP | Qualcomm Incorporated |
| Proposal 1: On the maximum number of beam pairs (N) in a single CSI report, support RRC configured candidate value of N = {1, 2, 3, 4}.   * Introduce UE capability on the maximum value of N, which limits the configured N. * Actual reported number of beam pairs in a single report is dynamically determined by UE and is upper bounded by the configured N.   Proposal 2: For group-based beam report in inter-cell mTRP, support that the two reported beams per group can be from serving and non-serving cells, respectively.  Proposal 3: For group-based beam report, the beam set (or TRP) index per candidate beam is implicitly determined by the corresponding CMR resource set.   * Bit width per reported SSBRI/CRI is determined based on the number of SSB/CSI-RS resources from the associated CMR resource set.   Proposal 4: For L1-SINR based group report, gNB configures multiple candidate beam groups, among which UE reports beam group(s) such that the two beams per group can be received simultaneously.   * The corresponding CMR/IMR per beam in each candidate group should be configured such that the reported L1-SINR per beam reflects cross-beam interference from the other beam in the group.   Proposal 5: For group-based beam report, it can be considered for UE to report throughput related metric per reported beam group, including sum of CQI, capacity, mutual info.  Proposal 6: For group-based beam report, UE can report the two beams are received by the same or different Rx beams.  Proposal 7: For group report, gNB can signal the purpose (for throughput or reliability), operation mode (FDM/SDM/TDM), and corresponding beam pair selection criterion (based on sum or minimum of metrics of the two reported beams).  Proposal 8: Either cell-specific or TRP specific BFR, but not both, can be configured in the same CC.  Proposal 9: Support UE capability on the maximum number of RS per BFD-RS set, which includes a candidate value of 1.  Proposal 10: When two PUCCH-SR resources are configured in a cell group, they can be mapped to the same schedulingRequestId to avoid two schedulingRequestIds.   * The PUCCH-SR resource associated with the failed BFD-RS set is used to transmit the SR.   Proposal 11: Support UE capability on the total number of resources across all BFD-RS sets per DL BWP.  Proposal 12: For mDCI mTRP, support both explicit and implicit per-TRP BFD.  Proposal 13: For mDCI mTRP, the 1-to-1 association between each explicit BFD-RS set and the corresponding NBI-RS set can be indicated by configuring the same CORESETPoolIndex for them.  Proposal 14: For mDCI mTRP, the implicit BFD RSs associated with a CORESETPoolIndex can be the QCL-TypeD RSs in up to X TCI states for CORESETs sharing the same CORESETPoolIndex.   * X can be determined in spec or via UE capability. * In absence of QCL-TypeD RS, the single QCL source RS in the TCI state can be the implicit BFD RS.   Proposal 15: For each PUCCH-SR resource in a cell group:   * Two candidate spatial relations can be configured for the one PUCCH-SR resource. * Among the two spatial relations, UE can select the one not associated with failed TRP for transmission. * The same PUCCH-SR can be triggered by both per-TRP BFR and SCell BFR.   Proposal 16: A CC can be configured with either per-TRP BFR or PCell/SCell BFR. A modified BFR MAC-CE from R16 can indicate corresponding BFR info per CC based on the configured BFR type.   * If a CC is configured with per-TRP BFR, MAC-CE will indicate CC ID, failed TRP ID, new beam ID. * If a CC is configured with SCell BFR, MAC-CE will indicate failed CC ID and new beam ID. * If a CC is configured with PCell BFR, MAC-CE will indicate the failure event.   Proposal 17: If no dedicated PUCCH-SR or if cell level failure of PCell happens, the modified BFR MAC-CE can be transmitted via RACH procedure.  Proposal 18: After 28 symbols from receiving the gNB response, at least PDCCH/PUCCH beam will be reset for the failed TRP if a candidate beam is reported for it.   * In presence of PDCCH repetition, the 28 symbols start from the last repetition. * The SCS of the 28 symbols is the largest SCS of the response receiving CC and the CC with failed TRP.   Proposal 19: In multi-DCI based mTRP, the existing QCL prioritization rule for overlapped CORESETs should be applied within CORESETs with same CORESETPoolIndex.  Proposal 20: For power saving, UE can request to disable the dual default PDSCH beams in mTRP. | | |
| R1-2104734 | Enhancements on beam management for multi-TRP | OPPO |
| Observation 1: L1-SINR measurement is not feasible in beam reporting option 2.  Observation 2: Option 1 could have lower reporting overhead than Option 2 when the UE use separate panel(s) to receive beams and measure L1-RSRP of each beam from two different TRPs.  Observation 3: Option 3 does not provide any new function that is not supported by either Option 1 or Option 2, and Option 3 complicate the system design.  Observation 4: The explicit BFD-RS configuration method unnecessarily increases the signaling overhead  Observation 5: The explicit method for BFD-RS does not work given the fact that the TCI state of PDCCH can be updated by MAC CE and DCI  Observation 6: Per the design of RAN2, one SR configuration has at most one PUCCH resource per BWP.  Proposal 1: For beam reporting option 2, support two CMR resource sets in resource setting.  Proposal 2: The bitwidth of each SSBRI/CRI is based on the SSB/CSI-RS resources in each set.  Proposal 3: For beam reporting option 2, support two CMR resource sets in resource setting.   * Support N = {1, 2} * The value of N is fixed and configured by RRC   Proposal 4: Do not support L1-SINR measurement for beam reporting option 2.  Proposal 5: In addition to beam reporting option 1, support Option 1 with L1-RSRP measurement:   * In Option 1: UE reports N = 2 groups of M = 1/2 CRI/SSBRI and corresponding L1-RSRP. The CRI/SSBRI reported in 1st group are for the CMR resources of 1st the TRP and the CRI/SSBR reported in 2nd group are for the CMR resources of the 2nd TRP.   Proposal 6: For M-DCI multi-TRP BFR, only support implicit BFD-RS configuration   * For each TRP, the UE derives the BFD-RS set according the TCI states configured to the CORESETs associated with the CORESETPoolIndex = 0 or 1. * The number of BFD-RS in each per-TRP BFD-RS set is <= 2.   Proposal 7: Associate each new beam identification RS set with a CORESETPoolIndex value = 0/1.  Proposal 8: Keep the current RAN2 design and at most one PUCCH per BWP is configured for one SR configuration.  Proposal 9: Two SR configurations can be used for mTRP BFR and the per system implementation, the gNB can configure the following:   * One SR configuration corresponds to the beam failure of TRP#1 and another SR configuration corresponds to the beam failure of TRP#2 * When beam failure is claimed for one TRP, the UE can trigger the SR in the corresponding SR configuration.   Proposal 10: In MAC-CE BFRQ, the UE reports the CORESETPoolIndex value corresponding to the failed TRP in M-DCI based mTRP system.  Proposal 11: UE switches the QCL of CORESETs associated with the CORESETPoolindex value with beam failure to qnew after TRP-specific BFRQ is received successfully.  Proposal 12: Do not support updating the Tx beam of PUCCH resource after per-TRP BFR in M-DCI based mTRP system.  Proposal 13: Study to support CFRA-based BFR for per-TRP BFR in SpCell.  Proposal 14: CBRA-based transmission can be triggered when MAC CE based BFRQ transmission does not work in SpCell. | | |
| R1-2104891 | Multi-TRP enhancements for beam management | Intel Corporation |
| Proposal-1: Associate two CMR resource sets, each representing a TRP/panel in a CSI-ResourceConfig/CSI Resource Setting (when mTRP measurement and reporting is enabled)  Proposal-2: Maximum value of N can be set to {1, 2, 3, 4} and the value of N can be fixed by RRC configuration as a starting point.  Proposal-3: for the agreed group based beam reporting enhancement (option-2) and the reporting of beam-pairs, Alt-2 may be supported. Support UE indication (or alternatively gNB request) of whether the reported beam-pair can be used for spatial multiplexing for diversity  Proposal-4: a UE is not expected to receive downlink signals/channels or transmit uplink signals/channels in a time overlapping manner with a beam pair combination that it has not reported within a certain interval of time.  Proposal-5: Cell-specific and TRP-specific BFR configuration in the same CC is not supported  Proposal-6: LRR generated as a result of beam failure in a SCell configured with a single BFD /NBI-RS set can be carried by one of two configured PUCCH-SR resources for MTRP-BFR.  Proposal-7: Support implicit BFD-RS configuration, where BFD-RS set k is derived from TCI states of CORESET with the same CORESETPoolIndex. Extend configuration of CORESETPoolIndex to S-DCI in Rel.17 when TRP-specific BFR is configured  Proposal-8: the first BFD-RS set can be associated with the first NBI-RS set, and second to the second.  Proposal-9: If 2 PUCCH-SRs are configured for BFR, in all cases UE selects 1 out of the 2 PUCCH-SRs for transmission. The selection method can be left to UE implementation.  Proposal-10: CBRA-based transmission can be triggered on a SpCell for per-TRP BFR when beam failure is detected on all BFD-RS sets on the SpCell  Proposal-11: Support a single PUCCH-SpatialRelationInfo configuration for each dedicated PUCCH-SR as a baseline.  Proposal-12: The MAC-CE contents for SCell/PCell for 1 and 2 TRP failure cases are summarized below:   |  |  |  | | --- | --- | --- | |  | 1 TRP failure | 2 TRP failure | | SCell configured with 1 BFD/NBI set | (a new beam index or no new beam identified) + failed CC index [Rel-16 behaviour] | Not applicable | | SCell configured with 2 BFD/NBI set | ((a new beam index + NBI set index) or (no new beam identified)) and failed CC index | ((a new beam index + NBI set index) or (no new beam identified)) for TRP1, TRP2 and failed CC index | | PCell configured with 1 BFD/NBI set | No MAC-CE, RACH fall-back [Rel-15 behaviour] | Not applicable | | PCell configured with 2 BFD/NBI set | ((a new beam index + NBI set index) or (no new beam identified)) and failed CC index | No MAC-CE, RACH fall-back [Rel-15] | | | |
| [R1-2105060](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105060.zip) | Enhancements on beam management for multi-TRP | Fujitsu |
| Proposal 1: For M-TRP beam failure detection, support both explicit and implicit BFD-RS configuration.  Proposal 2: For explicit BFD-RS configuration, each BFD-RS set should be configured with a CORESETPoolIndex for TRP identification.  Proposal 3: For implicit BFD-RS configuration, CORESETPoolIndex can be used for the derivation of BFD-RS sets.  Proposal 4: An NBI-RS set is associated with a BFD-RS set if they correspond to the same TRP (i.e. same value of CORESETPoolIndex).  Proposal 5: For a UE configured with two PUCCH-SR resources in a cell group when beam failure is detected in a one or more CCs in one or more of BFD-RS sets configured in one or more of CCs, Alt-2 is preferred:   * PUCCH-SR resource associated with failed BFD-RS set, association details FFS   Proposal 6: If beam failure is detected in a TRP, the corresponding BFRQ shall at least convey the index of the failing TRP.  Proposal 7: After a UE informs a beam failure event for a TRP and the corresponding gNB response is received, the UE shall adjust the transmission/reception parameters for the UL/DL associated with the TRP. | | |
| R1-2105089 | Views on Rel-17 multi-TRP BM enhancement | Apple |
| Beam report  Proposal 1: Do not support option 1 or option 3 for beam measurement enhancement.  Proposal 2: Do not support N>2 for beam measurement enhancement.  Proposal 3: Do not support option 2 to measure L1-SINR for beam measurement enhancement  Proposal 4: Support UE reports whether beams are received with different RX beams or not   * Support UE reports maximum number of layers per Rx beam as a UE capability   Proposal 5: Support gNB to configure 2 CMR sets in a CSI-reportConfig for group-based beam reporting option 2, where CMR resources in a set is associated with a TRP.  BFR – mDCI mode  Proposal 6: Support to introduce UE capability to report maximum number of RS per BFD RS set (Alt2)  Proposal 7: Support to derive the BFD RS based on RSs configured in the TCI state for CORESETs with a CORESETPoolIndex  Proposal 8: Support to map the BFD and CBD RS set with the same set index  Proposal 9: RAN1 should clarify whether the 2 PUCCH resources for SR are associated with the same SR configuration or different SR configuration first.   * If 2 PUCCH resources are associated with a SR configuration, UE can trigger SR with any PUCCH resource when any TRP fails * If 2 PUCCH resources are associated with different SR configuration, UE can trigger the corresponding SR when one particular TRP fails   Proposal 10: Support BFR MAC CE to report failed TRP index(es).  Proposal 11: It is up to gNB implementation whether to configure 2 spatial relation for a PUCCH-SR or not.  Proposal 12: After K symbols after UE receives the BFR response, support to apply the new beam to all the data and control channel corresponding to the failed TRP across CCs in a band.  Proposal 13: With regard to the UE power consumption and common beam operation, BFR can only be enabled in one CC within a band.  BFR – sDCI mode  Proposal 14: For sDCI mode, before deciding the details, the first issue is to define when the TRP-specific BFR should be enabled or disabled with regard to dynamic switching between sDCI and sTRP mode   * UE should not be required to always keep TRP-specific BFR when it is switched into sTRP mode * FFS: UE behaviour on the counter and timer maintenance for TRP-specific BFR when it is switched to sTRP mode from sDCI mode   Simultaneous reception  Proposal 15: **Support to release constraints due to QCL -TypeD collision for UEs that can receive signals with two different QCL -TypeD properties**   * **The following options are considered:**   + **Option 1: To enhance priority rule to facilitate UE  to receive downlink  signals with two different QCL -TypeD properties,** **e.g. PDCCH QCL prioritization rule enhancement**   + **Option 2: To** **release some scheduling restrictions which mandate gNB to schedule downlink  signals with the same QCL -TypeD property or prohibit to schedule some downlink  signals overlapped in time domain,** **e.g. PDSCH + SSB**   + **Other options are not precluded** * **FFS: definition of QCL -TypeD collision, e.g., different QCL Type D RS(s) under the same UE panel.** | | |
| R1-2105153 | Enhancements on beam management for multi-TRP | Sony |
| 1. Support to introduce UE capability on Ncap. 2. Support RRC configured value N (Alt1) which could be selected from {1, 2, 3, 4} (Alt2) for flexibility. 3. On CMR resource configuration, support two CMR resource sets. 4. For multi-TRP operation, additionally support Option 1 of group-based beam reporting. 5. For group-based beam reporting of multi-TRP, support L1-SINR as beam selection metric. 6. If L1-SINR is supported as beam selection metric, study whether L1-SINR should reflect inter-beam interference. 7. Support TRP-specific BFR and cell-specific BFR configured on the same CC. 8. For BFD-RS sets determination, support explicit configuration per BWP per TRP. If there is no explicit configuration, support (implicit manner) UE to determine BFD-RS set(s) by itself. 9. When TRP-specific BFR happens, support UE to select the PUCCH-SR associated with non-failed TRP. 10. For TRP-specific BFRQ, support to use CORESETPoolIndex(es) in one BFRQ MAC CE as failed TRP ID(s). 11. For QCL assumption in DL and spatial relation in UL after BFRR, support to reuse Rel.15/16 rule (applying new beam for PDCCH and PUCCH) in a TRP-specific manner. 12. Specify the QCL relationship among SRS resource sets on different directional antenna panels. 13. Specify the QCL relationship among CSI-RS resource sets/SSBs on different directional antenna panels. 14. Specify the QCL relationship among SRS resource sets/CSI-RS resource sets/SSBs on different BWPs/CCs (intra band). 15. A panel ID explicitly configured in spatialRelationInfo or unified TCI can be beneficial for panel specific operation. | | |
| R1-2105211 | Enhancements on beam management for multi-TRP | ETRI |
| Proposal 1: For the maximum number of beam pairs/groups (N) that can be reported in a single CSI-report, support Alt2, i.e., support maximum value N = {1, 2, 3, 4}.  Proposal 2: For the number of beam pairs/groups (N) reported in a single CSI-report, support Alt1, i.e., the value of N is fixed by RRC configuration.  Proposal 3: On CMR resource configuration for beam reporting, support to adopt “subset”.  Proposal 4: L1-SINR should be supported to enhance the beam measurement/reporting in Rel.17.  Proposal 5: Support both explicit and implicit BFD-RS configurations as in Rel.15/16.  Proposal 6: For implicit BFD-RS configuration, BFD-RS set for each TRP can be provided implicitly by the TCI states for the CORESETs with a given CORESETPoolIndex.  Proposal 7: On the maximum number of RS per BFD-RS set, support Alt2, i.e., max value is a UE capability, including possible candidate value of 1.  Proposal 8: For the association details between BFD-RS sets and NBI-RS sets, support the 1-to-1 association that the first BFD-RS set is associated with the first NBI-RS set, and the second to the second.  Proposal 9: The information of the failed TRP which can be BFD-RS set index or CORESETPoolIndex should be conveyed in the BFRQ MAC-CE.  Proposal 10: For the TRP-specific BFR, for a UE configured with two PUCCH-SR resources in a cell group when beam failure is detected in a one or more CCs in one or more of BFD-RS sets configured in one or more of CCs, support Alt-1, i.e., PUCCH-SR resource associated with other/non-failed BFD-RS set.  Proposal 11: If both TRPs fail on SCell, the UE may also choose one of the two PUCCH-SR resources.  Proposal 12: PUCCH-SR resource can be configured with 2 spatial relations.  Proposal 13: After 28 symbols from receiving the gNB response to BFRQ MAC-CE, UE can apply the new beam indicated in MAC-CE (if a new candidate beam is found) for PDCCH/PUCCH on the failed TRP. | | |
| R1-2105248 | Discussion on beam management for multi-TRP | NEC |
| Proposal 1: Both explicit and implicit BFD RS configuration should be supported, and for implicit configuration, UE can determine each BFD RS set from associated subset of CORESETs respectively.  Proposal 2: Two PUCCH-SR resources in a cell group can be configured if Spcell is configured with two TRPs, otherwise it seems unnecessary.  Proposal 3: When two PUCCH-SR resources in a cell group is configured, PUCCH-SR resource associated with other/non-failed BFD-RS set (i.e. Alt-1) should be selected at least when the Spcell is configured with two TRPs, and either one of the two PUCCH-SR resource can be selected when the Spcell is only configured with one TRP.  Proposal 4: TRP specific beam failure recovery for SFN PDCCH transmission schemes should be further studied, for example, association between the BFD RS set and CORESET with two active TCI states, and UE behavior when one TRP is failed. | | |
| R1-2105275 | Enhancements on Beam Management for Multi-TRP/Panel Transmission | Nokia, Nokia Shanghai Bell |
| BM Related observations/proposals  Proposal 2-1: In addition to option 2, support Option 3 for ideal/non-ideal backhaul scenario.  Observation 2-1: When two CMR resource sets are used, additional specification effort is required for AP CSI triggering state, CRI indication and UE capability for maximum CSI-resources in a set.  Observation 2-2: When two CMR resource subsets are used, the existing CSI framework can be reused with the consistency with CSI report setting for CSI acquisition.  Proposal 2-2: For group-based beam reporting for multi-TRP operation, support two CMR resource subsets to group CMR resources corresponding to a TRP.  Observation 2-3: It is possible to utilize existing spatial QCL-typeD relationships between different RSs with the grouping of SSBs, where the UE understand the beams can be associated with a TRP.  Observation 2-4: For inter-cell M-TRP, SSB grouping by PCI is already supported.  Proposal 2-3: Support both explicit and implicit methods for mapping a subset of CMR resources to a TRP.   * For CMR of SSB resources, support explicit method, a subset indication bitmap is included in CSI-resource Setting. * For CMR of NZP-CSI-RS resources, support implicit method where SSB is grouped by a common SSB bitmap (or PCI index), and CSI-RS is associated with a subset/group by the QCLed SSB.   Proposal 2-4: For enhanced group-based beam reporting for multi-TRP, support N={1,2,3,4} beam-pairs for a group-beam report.  Proposal 2-5: For enhanced group-based beam reporting for multi-TRP, support Alt2 (The value of N is upper bounded by a maximum value Nmax configured by RRC, and dynamically selected/indicated by UE)  Observation 2-5: UE Rx panel-related information should be defined for the general BM aspect first.  Proposal 2-6: Support the enhanced group-beam reporting for L1-SINR report only when dedicated IMR is configured.  Observation 2-6: It is beneficial to configure beam reporting criteria that imposes UE to rank and report only measured CSI resources being within a certain power window or above a power threshold.  Observation 2-7: From latency reduction perspective, it is beneficial to consider additional criterion that can take into account latencies associated with multi-panel reception.  Proposal 2-7: Support beam reporting criteria that imposes UE to rank and report only measured CSI resources being within a certain power window or above a power threshold.  Observation 2-8: To guarantee reliable multi-TRP operation with enhanced group based beam reporting, it is beneficial to develop a fallback mechanism/procedure that enables UE to recover from situation where enhanced beam reporting condition is not fulfilled.  Proposal 2-8: Consider different alternatives as fallback mechanisms, such as:   * Alt-1: use Rel-15 group reporting (with a restriction on ‘per TRP’ with predefined TRP) * Alt-2: use Rel-15 non-group reporting (no restriction on simultaneous reception) * Alt-3: network configures the fallback reporting (based on Alt-1 or Alt-2)   Proposal 2-11: For non-group based beam reporting, support association of a reporting setting to another reporting setting to ensure the UE’s simultaneous reception from multi-TRP for multi-DCI based multi-TRP scheme,   * UE shall select beams to be reported with the consideration of the simultaneous reception from two TRP.   Proposal 2-10: For the association of CSI report settings, the associated CSI-ResportSettingID is included in the CSI-ReportSetting.  Proposal 2-11: Study method to indicate beams simultaneous reception capability.  BFR Related observations/proposals  Observation 3-1: Both TRPs have the corresponding BFD-RS sets and the sets can be in failure at the same time.  Observation 3-2: Candidate beams are indicated from the candidate beam lists and there may not be candidates available for the failed TRPs  Proposal 3-1: Define UE behavior when no new candidate can be indicated for the failed TRP.  Observation 3-3: If both TRPs fail but candidates are available, UE could use the TRP specific failure recovery. In case both TRPs fail but no new candidate beam can be indicated UE could switch to cell-specifc BFR (rel15/16 BFR)  Proposal 3-2: Cell-specific and TRP-specific BFR can be configured in the same serving cell (at least SpCell).  Proposal 3-3: If both TRPs fail and candidates are available, UE uses the TRP specific failure recovery. In case both TRPs fail but no new candidate beam can be indicated UE switches to cell-specifc BFR (fallback to rel15/16 BFR)  Observation 3-4: The current maximum number of BFD-RS in set of q0 is 2 even in mTRP scenario.  Observation 3-5: Neither Alt1 or Alt2 (with capability of less 3) does not cope with the increased maxmimum number of CORESETs with active TCI states.  Proposal 3-4: For implicit configuration, adopt a mechanism to select the RS to be included into set of q0 . Similar mechanism as specified for rel-15 RLM is used if/when number of activated TCI States for CORESETs exceeds the capability of maximum number of BFD-RS for respective set of q0.  Proposal 3-5: Each failure detection resource set is associated with a respective candidate beam reference signals list (candidateBeamRSList). The association between BFD-RS set and candidate beam RS list for respective sets are configured by network. Signaling details can be left to RAN2  Proposal 3-6: Support configuration of beam failure detection resource sets (q0) per coresetPoolIndex value for M-DCI.  Proposal 3-7: Support implicit configuration of two sets of BFD-RS for the other M-TRP scenarios like M-TRP PDCCH repetition (both SFN, Non-SFN) and S-DCI M-TRP schemes (Rel-16).  Proposal 3-8: Configuration of candidate beam RS(s) (SSB/CSI-RS) to the NBI-RS set(s) is up to network implementation.  Observation 3-6: UE can transmit CBRA for transmiting MAC CE for mTRP BFR regardless of PUCCH-SR configuration.  Observation 3-7: MAC CE for mTRP BFR can be transmitted on available UL grant without sending an SR.  Proposal 3-9: No restriction to perform CBRA for mTRP BFR is considered.  Proposal 3-10: PUCCH-SR for mTRP can be mapped to a configured SR ID that may be shared with other functionality. Details are up to RAN2.  Proposal 3-11: When two PUCCH-SR resources are configured, for PUCCH-SR resource selection rule, Support Alt-2, PUCCH-SR resource associated with failed BFD-RS set.  Proposal 3-12: To indicate the failed TRP, an indication of the failed beam failure detection resource set is to be carried by the MAC CE. | | |
| [R1-2105293](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105293.zip) | Enhancements on beam management for multi-TRP | Samsung |
| Proposal 1: For Option-2 group based beam reporting,   * Support Nmax = 4, and candidate values of N = {1, 2, 3, 4} * Support dynamic selection and indication of N by the UE   Proposal 2: For Option-2 group based beam reporting, support two CMR subsets per resource setting   * CMR set specific parameters are configured for all CMRs in the set, i.e., across the two subsets * CMRs are indexed within the set, i.e., across the two subsets   Proposal 3: Support reporting the RX panel information/status including at least how the reported resource indictors/beam metrics are associated with different RX filters/panels to the network along with the beam report(s)  Proposal 4: Support both explicitly and implicitly configured BFD RSs for multi-TRP BFR enhancements   * For implicit BFD RSs configuration, strive for a unified solution for both single-DCI and multi-DCI based frameworks; support BFD RS set k (k = 0, 1) associating with CORESETs subset k (k = 0, 1)   Proposal 5: In the same CC, if two separate TRP-specific BFRs are detected within a time window configured by the network, a cell-specific BFR is triggered.  Proposal 6: For per TRP BFR, when a UE is configured with two PUCCH-SR resources in a cell group and when beam failure is detected in one or more of BFD RS beam sets in one or more of CCs,   * If a PUCCH-SR resource is associated with a single UL spatial filter, support PUCCH-SR resource associated with working/non-failed BFD RS beam sets * If a PUCCH-SR resource is associated with two UL spatial filters, the selection of PUCCH-SR resource is up to UE implementation and/or subject to network’s indication/configuration | | |
| R1-2105367 | Enhancement on beam management for MTRP | MediaTek Inc. |
| MTRP BFR  Proposal 1: CBRA-based BFR and TRP-specific BFR can be configured simultaneously in SpCell  Proposal 2: Support both explicit and implicit BFD-RS set configuration for M-TRP BFR   * Explicit manner: N RS resources in a BFD-RS set are determined according to the N RS indexes configured in the BFD-RS set * Implicit manner: N RS resources in a BFD-RS set are determined from the TCI state(s) indicated for CORESET(s) with a same CORESETPoolIndex   Proposal 3: For S-DCI, reuse Rel-16 CORESET pool configuration ONLY for M-TRP BFR when M-TRP BFR is configured in the DL BWP  Proposal 4: Support 1-to-1 association between each BFD-RS set and a CORESETPoolIndex  Proposal 5: Support 1-to-1 association between each BFD-RS set and a PUCCH-SR resource   * Alt2: PUCCH-SR resource associated with a BFD-RS set is selected if beam failure is detected in the BFD-RS set   Proposal 6: For a UE configured with two PUCCH-SR resources in a cell group when beam failure is detected in a one or more CCs in one or more of BFD-RS sets configured in one or more of CCs   * If only one PUCCH-SR resource is selected, the selected PUCCH-SR resource is used for triggering SR * If two PUCCH-SR resources are selected, one of the selected PUCCH-SR resources is used for triggering SR up to UE implementation   Proposal 7: A single MAC-CE is used for BFRQ report at least for TRP-specific BFR in all CCs in a cell group   * For each CC configured with TRP-specific BFR, a bitmap in the MAC-CE is used to indicate which BFD-RS set(s) in the CC is failed * For each failed BFD-RS set in a CC, the MAC-CE carries information whether a new candidate beam is found, and new beam index (if found).   Proposal 8: Support using BFRQ MAC-CE to indicate TRP failure in a SpCell in any PUSCH.  Proposal 9: If UE declares beam failure for a BFD-RS set of a CC and indicates a new beam identified for the BFD-RS set in a BFRQ MAC-CE:   * After a duration from UE detects NW response to the BFRQ MAC-CE, UE shall monitors PDCCH in all CORESETs belonging a same CORESET pool using the indicated new beam, where the CORESET pool is associated with the failed BFD-RS set   Beam measurement/reporting enhancement to facilitate inter-TRP beam pairing  Proposal 10: For beam reporting option 2,   * Support a UE capability of the maximum number of beam pairs/groups that supported in a single CSI-report with candidate {1, 2, 3, 4} * The number of beam pairs/groups (N) reported in a single CSI-report is fixed by RRC configuration according to the UE capability   Simultaneous reception of DL with different QCL-TypeD assumptions  Proposal 11: Collision handling for simultaneous transmission of DL channels should be enhanced at least for PDCCH+PDCCH and PDCCH+PDSCH | | |
| R1-2105542 | Enhancement on beam management for Multi-TRP | Xiaomi |
| Proposal 1: UE need to know the association between RSs and TRP (or cell) to facilitate inter-TRP beam pairing by group based beam reporting.  Proposal 2: To report L1-SINR considering the inter-TRP interference with at least Option 2.  Proposal 3: To indicate that beams in one group are received by a single panel or two different panels.  Proposal 4: Prefer Alt 1: the value of N is fixed by RRC configuration.  Proposal 5: Support both explicit and implicit per-TRP BFD-RS configuration.  Proposal 6: Implicit per-TRP BFD-RS configuration can be determined based on CORESETPoolIndex.  Proposal 7: Suggest to introduce a new value of CORESETPoolIndex for CORESET with two TCI states.  Proposal 8: Each one of two TCI states can be considered as TRP-specific BFD-RS of corresponding TRP.  Proposal 9: Both two TCI states of one CORESET can only be considered as cell-specific BFD-RS(s).  Proposal 10: Support NBI-RS across all NBI-RS sets.  Proposal 11: Support to configure both cell-specific and TRP-specific BFR on SpCell only.  Proposal 12: Prefer Alt 2 for PUCCH-SR resource selection when two PUCCH-SR resources are configured. | | |
| R1-2105590 | On Multi-TRP BFR | Convida Wireless |
| Proposal 1: Support both explicit and implicit configuration of BFD RS per TRP.  Proposal 2: Implicit determination of the first BFD-RS set follows implicit determination in Rel-15/16, but based on the first CORESET pool. Similarly for the second BFD-RS set.  Proposal 3: Support Alt 1, i.e. up to two BFD-RS per BFD-RS set.  Observation 1: The current specification can support implicit determination of a set of BFD-RS from multiple TCI states, e.g. two activated TCI states for one CORESET.  Proposal 4: Implicitly determined per-TRP BFD-RS sets for HST-SFN Scheme 1 (two activated TCI states for a CORESET) can be discussed after completion of BFD for single-TCI CORESETs.  Proposal 5: For Rel-17 multi-TRP BFR with two BFD-RS sets, two NBI-RS sets are configured.  Proposal 6: The details of the 1-to-1 association between BFD-RS sets and NBI-RS sets are left to RAN2.  Proposal 7: If the UE detects beam failure in the first BFD-RS set, it shall try to find a new candidate beam from the first NBI-RS set with L1-RSRP above a threshold, if any. If the UE detects beam failure in the second BFD-RS set, it shall try to find a new candidate beam from the second NBI-RS set with L1-RSRP above a threshold, if any.  Proposal 8:  For multi-TRP BFR, upon request from higher layers to evaluate candidate beams in a first NBI-RS set, the UE indicates to higher layers whether there is at least one periodic CSI-RS configuration index and/or SS/PBCH block index from the first NBI-RS set with corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, and provides the periodic CSI-RS configuration indexes and/or SS/PBCH block indexes from the first NBI-RS set and the corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, if any.  For multi-TRP BFR, upon request from higher layers to evaluate candidate beams in a second NBI-RS set, the UE indicates to higher layers whether there is at least one periodic CSI-RS configuration index and/or SS/PBCH block index from the second NBI-RS set with corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, and provides the periodic CSI-RS configuration indexes and/or SS/PBCH block indexes from the second NBI-RS set and the corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, if any.  Proposal 9: The NBI-RS sets are disjoint.  Proposal 10: Beam failure of both BFD-RS sets can be reported in the BFRQ MAC CE as well as both corresponding new candidate beams, if found.  Proposal 11: This sub-agenda item does not preclude that a PUCCH resource carrying SR, incl. SR for BFR, is configured/activated with two spatial relations, which was agreed in sub-agenda item 8.1.2.1.  Proposal 12: In the case of two dedicated PUCCH-SR resources, leave resource selection up to UE implementation (Alt-3).  Proposal 13: If an NBI-RS is indicated in the MAC CE, the TRP index can be determined from the NBI-RS index. If an NBI-RS index is not indicated in the MAC CE, i.e. reserved bits are included instead of NBI-RS index, then one of the inserted reserved bits can be used to indicate TRP index. | | |
| R1-2105666 | Beam Management Enhancements for Multi-TRP | AT&T |
| Proposal 1: L1-SINR measurement framework is used for multi-TRP joint transmission with multi-panel reception, in addition to L1-RSRP  Proposal 2: Non-group based beam reporting enhancements based on option 3 can be considered  Proposal 3: On CMR resource configuration for beam reporting option 2, adopt two CMR resource subsets, per periodic/semi-persistent CMR resource setting  Proposal 4: For beam reporting option 2, on the maximum number of beam pairs/groups (N) that can be reported in a single CSI-report, support maximum value N = {1,2,3,4}.  Proposal 5: Support both implicit and explicit BFD-RS configuration  Proposal 6: Support implicit BFD-RS configuration where CORESETs in the BWP are divided into multiple groups (e.g., each corresponding to a TRP/panel) and the BFD-RS set k is implicitly derived from the corresponding CORESET group. | | |
| [R1-2105672](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105672.zip) | Discussion on beam management for multi-TRP | ASUSTEK COMPUTER (SHANGHAI) |
| Proposal 1: PUCCH-SR resource selection when SR is triggered for TRP specific BFR cannot be done based on UE implementation.  Proposal 2: When SR is triggered for a TRP-specific BFR, the UE shall select PUCCH-SR resource associated with failed BFD-RS set for SR transmission. | | |
| R1-2105685 | Discussion on beam management for MTRP | NTT DOCOMO, INC. |
| Proposal 1   * + For Option 2,   + On the maximum value of N, support Alt2: Support maximum value N = {1, 2, 3, 4}.   + Support to introduce a UE capability Ncap on the maximum value of N in Rel-17.   + The value of N is fixed by RRC configuration.   + L1-SINR can be applied and the reported beams per group should reflect inter-beam interference.   + Support Option 1 with additional UE panel ID reporting for each group.   + Do not support Option 3.   Proposal 2   * + On CMR resource configuration for beam reporting Option 2, slightly prefer to support two CMR resource subsets, per periodic/semi-persistent/aperiodic CMR resource setting.   + Bitwidth of each SSBRI/CRI is determined based on the number of SSB/CSI-RS resources from the associated subset.   Proposal 3   * + On the maximum number of RS per BFD-RS set, support Alt2: max value is a UE capability, including possible candidate value of 1.   Proposal 4   * + For multi-DCI based MTRP,   + Support both explicit and implicit BFD-RS configurations for per-TRP based BFD/BFR.   + If BFD-RS is not explicitly configured, two sets of BFD-RS can be derived from QCL-TypeD RS of TCI state of CORESETs associated with different CORESETPoolIndex.   + The set of BFD-RS and the set of NBI-RS associated with the same CORESETPoolIndex are implicitly associated.   + For single-DCI based MTRP,   + Support explicit BFD-RS configuration for per-TRP based BFD/BFR and do not support implicit per-TRP BFD-RS.   + If BFD-RS is not explicitly configured, cell-specific implicit BFD-RS can be determined as Rel-16.   + The set of BFD-RS and the set of NBI-RS with the same set ID are implicitly associated.   Proposal 5   * + Either cell-specific or TRP-specific BFR can be configured for a CC. Do not support configuration of both cell-specific and TRP-specific BFR for a CC.   + Note: if TRP-specific BFR is configured on a SpCell, when two TRPs fail, RACH based BFR, which is cell-specific BFR, can be performed as fallback scheme. However, in this case, only TRP-specific BFR is configured, i.e., two BFD-RS sets are configured.   Proposal 6   * + Support up to one SR configuration for BFR, and up to two PUCCH-SR resources can be configured under the SR configuration for BFR.   Proposal 7   * + For PUCCH-SR configuration in a cell group for MTRP BFR, further study following two options.   + Option 1: two dedicated PUCCH-SR resources can be configured, only when SpCell is configured with per-TRP BFR;   + Option 2: two dedicated PUCCH-SR resources can be configured, if at least one serving cell regardless of SpCell or SCell is configured with per-TRP BFR.   Proposal 8   * + For PUCCH-SR resource selection rule in case of two PUCCH-SR resources for BFR, support ‘Alt-1: PUCCH-SR resource associated with other/non-failed BFD-RS set’ in principle with following details.   + For per-TRP BFD on SpCell,     - If SR is triggered due to one TRP failure on SpCell, PUCCH-SR resource associated with the other TRP is transmitted.     - In case of two-TRP beam failure (if one TRP is detected as beam failure, before BFR MAC CE transmission, the other TRP is also detected as beam failure) on SpCell, RACH-based BFR procedure should be triggered.   + For BFD on SCell,     - If SR is triggered due to per-cell BFR on a SCell, one from two PUCCH-SR resources is defined as default PUCCH-SR resource and is transmitted.     - If SR is triggered due to one TRP failure on a SCell, the selection and transmission of PUCCH-SR is related to whether TRP relationship across CCs is the same as SpCell or not, which can be configured by RRC signaling.       * If the TRP relationship on the SCell is the same as SpCell, PUCCH-SR resource associated with the other TRP is transmitted.       * If the TRP relationship on the SCell is different from SpCell, a default PUCCH-SR resource is transmitted.   Proposal 9   * + An enhanced BFR MAC CE is supported to indicate the failed TRP/CC information of one or multiple failed CCs,   + In case of beam failure on one TRP, the enhanced BFR MAC CE includes the indication of failed TRP information, failed CC information, whether new candidate beam is found and an indication of NBI-RS for the failed TRP, if found.   + In case of beam failure on two TRPs, the enhanced BFR MAC CE includes the indication of two TRPs information, failed CC information, FFS one or two whether new candidate beam is found and one or two NBI-RS indications, if found.   Proposal 10   * + In case of one TRP failure, UE behavior in Rel-16 after receiving gNB response for MAC CE based BFRQ can be applied to the failed TRP only.   + In case of two-TRP failure on a SCell, UE behavior in Rel-16 after receiving gNB response for MAC CE based BFRQ is related to whether one or two new candidate beam is reported.   Proposal 11   * + Support configuration of the association between PUCCH resource and TRP information (e.g., CORESETPoolindex, BFD-RS set ID, or NBI-RS set ID).   Proposal 12   * + Support a higher layer signaling to indicate whether to enable simultaneous reception of multiple channels/RSs with different QCL-TypeD at UE.   + Discuss the UE behaviour of simultaneous reception of multiple channels/RSs with different QCL-TypeD separately for single-DCI based MTRP and multi-DCI based MTRP cases, as well as different collision cases for different channels/RSs. | | |
| [R1-2105754](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105754.zip) | Discussion on beam management for multi-TRP | ITRI |
| Proposal 1: Support both explicit and implicit BFD-RS configuration  Proposal 2: For implicit BFD-RS configuration, BFD-RS is derived from CORESETs with a given CORESETPoolIndex  Proposal 3: For M-DCI in TRP-specific BFR, if one TRP is declared beam failure and if the time offset between the reception of the DL DCI and the corresponding PDSCH is less than a threshold, UE keeps one default Rx beam for receiving potential PDSCH transmitted from non-failed TRP | | |
| R1-2105781 | Enhancements on beam management for multi-TRP | LG Electronics |
| Proposal #1: For option 2, support only M=2.   * The value of N is fixed by RRC configuration.   Proposal #2: For option 2, support L1-SINR based beam pair/group reporting.   * Cross-beam (cross-TRP) interference can be considered for option 2.   + UE can report best N beam pair(s), each of which corresponds to (NZP-CSI-RS of TRP# 1, NZP-CSI-RS of TRP #2).   Proposal #3: Two different CMR resource subsets within a CMR resource set can be used for M-TRP specific CMR resource configuration, for the consistency of configuration with the agreed design for M-TRP CSI.  Proposal #4: Consider beam measurement and reporting enhancement for different TDD DL/UL configuration across multiple TRPs.  Proposal #5: Support both implicit and explicit BFD-RS configuration.   * For implicit BFD, each BFD-RS set is determined per CORESET pool when two CORESET pools are configured in the BWP. When single CORESET pool is configured in the BWP, gNB can configure two CORESET groups for TRP-specific BFD. * For explicit BFD, two BFD-RS sets are explicitly configured by gNB without any dependency on CORESET pool configuration or PDSCH TCI configuration.   Proposal #6: Support UE capability report on the number of BFD-RSs for M-TRP BFR.   * The maximum number of BFD-RSs per BFD-RS set can be also a UE capability. * Clarify whether/how to define BFD-RS selection rule for implicit BFD when the total number of QCL type-D RSs across CORESETs exceeds the reported UE capability.   Proposal #7: PUCCH-SR resource can be configured with up to two spatialRelationInfo.  Proposal #8: In case of multiple dedicated PUCCH-SR resources in a cell group, the selection rule between the two PUCCH-SR resources may not need to be specified.  Proposal #9: Support simultaneous configuration of cell-specific and TRP-specifc BFR for SpCell.  Proposal #10: Support indication of both TRP failure as well as a single TRP failure via a single BFR MAC-CE.   * One or two failed TRP index(es) can be conveyed by BFR MAC-CE in case of SCell M-TPR beam failure.   + TRP index can be BFD-RS set index from specification perspective * One failed TRP index can be conveyed by BFR MAC-CE in case of SpCell M-TRP beam failure.   + If both TRP is failed in SpCell, PRACH-based BFR procedure can be triggered.   Proposal #11: When the PDSCH is scheduled by a DCI format not having the TCI field present and the time offset between the reception of the DL DCI and the corresponding PDSCH is equal to or greater than a threshold timeDurationForQCL and two TCI states are configured to the CORESET used for the PDCCH transmission and one or no CORESET pool is configured,   * The two TCI states configured in the CORESET are applied for M-TRP PDSCH reception if the UE supports Rel-17 two beam based PDSCH reception and gNB configures such behavior. * Otherwise, one of the two TCI states, e.g., TCI state with lower index, is assumed as single beam for the PDSCH.   Proposal #12: When the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold timeDurationForQCL and two TCI states are configured to the CORESET associated with a monitored search space with the lowest controlResourceSetId in the latest slot and one or no CORESET pool is configured,   * The two TCI states configured in the CORESET are applied for M-TRP PDSCH reception if the UE supports Rel-17 two default beam behavior and gNB configures such behavior. * Otherwise, one of the two TCI states, e.g., TCI state with lower index, is assumed as single default beam.   Proposal #13: Clarify UE behavior when CORESET with multiple QCL type-D RSs is overlapped with another CORESET(s). | | |
| R1-2105806 | On beam management enhancements for simultaneous multi-TRP transmission with multi-panel reception | Ericsson |
| [Proposal 1 For beam measurement/reporting enhancement to facilitate inter-TRP beam pairing, Option 1 (UE reporting N>1 pair/groups and M>=1 beams per pair/group in a CSI report) and Option 3 (UE reporting M>=1 beams in N >1 CSI-reports corresponding to N report setting) are not supported in NR Rel-17.](#_Toc71671681)  [Proposal 2 Reuse simultaneousReceptionDiffTypeD-r16 UE capability to indicate if the UE is capable of receiving beams within a beam pair/group with different Rx spatial filters.](#_Toc71671682)  [Proposal 3 For potential UE panel related information feedback for group-based beam reporting, support either the indication of whether the reported beams in a group-based beam report are associated with different RX spatial filters, or the maximum number of supported layers corresponding to a beam group from the UE to the gNB (i.e., support Alt-2).](#_Toc71671683)  [Proposal 4 For beam measurement/reporting enhancement, support the maximum number N of beam pairs/groups in a single CSI report to be one of the candidate values in {1, 2, 3, 4} (i.e., support Alt2).](#_Toc71671684)  [Proposal 5 For beam measurement/reporting enhancement, support the exact number of beam pairs/groups (N) to be reported in a single report to be fixed by RRC configuration (i.e., support Alt1).](#_Toc71671685)  [Proposal 6 For beam measurement/enhancement to facilitate inter-TRP beam pairing, reuse the two CMR groups framework agreed for multi-TRP CSI where each beam in a beam group/pair is selected from one of the two CMR groups (i.e., support two CMR resource subsets in a resource set).](#_Toc71671686)  [Proposal 7 In NR Rel-17, support both explicit and implicit BFD-RS configuration in order to support M-TRP beam failure detection.](#_Toc71671687)  [Proposal 8 In NR Rel-17, support explicit M-TRP BFD-RS configurations for both multi-DCI based M-TRP and single-DCI based M-TRP.](#_Toc71671688)  [Proposal 9 In NR Rel-17, support implicit M-TRP BFD-RS configurations only for multi-DCI based M-TRP.](#_Toc71671689)  [Proposal 10 In NR Rel-17, support per-TRP BFD-RS configurations for both intra-cell and inter-cell multi-DCI based multi-TRP operation.](#_Toc71671690)  [Proposal 11 When two TCI states are activated for a CORESET, support inclusion of reference signals used as QCL sources in the two activated TCI states as BFD-RSs in the single BFD-RS set . If any of the activated TCI states contains two reference signals, the UE will use the reference signal configured with QCL-TypeD](#_Toc71671691)  [Proposal 12 Regarding PUCCH-SR resource selection when SR is triggered when beam failure is detected, support selecting a PUCCH-SR resource associated with the non-failed BFD-RS set.](#_Toc71671692) | | |
| R1-2105818 | Discussion of enhancements on beam management for Multi-TRP | Asia Pacific Telecom, FGI |
| Proposal 1: Support configuring transmission of cell-specific BFRQ and TRP-specific BFRQ in one serving cell.  Proposal 2: Support explicit BFD-RS configuration for both M-DCI and S-DCI TRP-specific BFR procedure.  Proposal 3: Support implicit BFD-RS configuration at least for M-DCI TRP-specific BFR procedure.  Proposal 4: For TRP-specific BFD-RS, the following details are agreed:   * The maximum reported number of BFD-RS(s) per set is 2 as starting point, * The maximum reported number of all BFD-RS in a BWP is 5 for explicit configuration, and 4 for implicit configuration.   Proposal 5: PUCCH-SR resource can be activated two spatial relations for repetition.   * Note: no further selection is imposed on activated spatial relations of PUCCH-SR resource, if two are activated.   Proposal 6: Selection of PUCCH-SR resource is UE implementation, if configured two PUCCH-SR resources.  Proposal 7: For PCell/PSCell, agree the followings for TRP-specific BFRQ:   * Do not introduce RACH-based BFRQ transmission as fallback mechanism for one failed TRP; * When both TRP-specific BFD-RS sets are measured below quality, UE transmits cell-specific BFRQ as Rel-15/16.   Proposal 8: For SCell, agree the followings for TRP-specific BFRQ:   * Do not introduce RACH-based BFRQ transmission as fallback mechanism for one failed TRP; * Postpone discussion on relationship between cell-specific BFRQ and TRP-specific BFRQ until the design of MAC-CE for TRP-specific BFRQ is ready. | | |
| R1-2105836 | Enhancements on beam management for multi-TRP | TCL Communication Ltd. |
| Proposal 1: For the CMR configuration in group based beam reporting, two CMR resource subsets per CMR resource setting is preferable.  Proposal 2: For the CMR configuration in group based beam reporting, the association between CMR resource subset and TRP should be studied.  Proposal 3: Regarding the maximum number of beam pairs/groups (N) that can be reported in a single CSI-report, support reporting up to 4 beam pairs/groups, i.e., Alt2 is preferable.  Proposal 4: Regarding the number of beam pairs/groups reported in a single CSI-report, the number of actual beam groups/pairs reported in a single CSI-report can be dynamically selected/indicated by UE, i.e., Alt2 is preferable.  Proposal 5: For the multiple beam pairs/groups, the beam pair selection criterion should be studied and the CSI based beam pair selection criterion could be considered.  Proposal 6: Regarding the maximum number of RS per BFD-RS set, max value based on a UE capability is preferable, i.e., support Alt2.  Proposal 7: If both TRPs fail in SCell, support the simultaneous configuration of cell-specific BFR and TRP-specific BFR in the same CC.  Proposal 8: If both TRPs fail in SpCell, support the simultaneous configuration of cell-specific BFR and TRP-specific BFR in the same CC.  Proposal 9: For the PUCCH-SR resource selection in the multi-TRP BFR, the PUCCH-SR resource can be selected according to the order of the available PUCCH-SR resource index(es).  Proposal 10: If both TRPs fail in SCell, two sets of failed TRP related information could be carried in a single BFRQ MAC CE to recover both the failed TRPs in one BFR procedure. | | |