**3GPP TSG-RAN WG4 Meeting #94-e R4-2002313**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 8.11.2, 8.11.2.1, 8.11.2.2, 8.11.2.3, 8.11.2.4

**Source:** Moderator (Samsung)

**Title:** Email discussion summary for RAN4#94e\_#59\_NR\_eMIMO\_RRM

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion and provide some guidelines for email discussion if necessary.*

Rel-16 NR eMIMO WI (i.e., Enhancements on MIMO for NR) is a RAN1 leading WI with below major enhancement in RAN1 area, in which the following items are identified for having RAN4 RRM requirement impact, based on previous RAN4 discussion:

* Enhancements on multi-beam operation
	+ DL/UL beam indication with reduced latency and overhead
	+ Beam failure recovery for SCell
	+ L1-SINR measurement

In last RAN4 meeting (RAN4#93), WF is approved as R4-1915850, in which agreement from online session is summarized and way forward is captured for above three aspects.

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

As the rapporteur for eMIMO WI, we would like to suggest the following candidate target of 1st and 2nd round email discussion:

* 1st round: Collect more views on all topics, while the following clarification achieved:
* 2nd round: Based on results from 1st round, proceed as much as possible.

# Topic #1: L1-SINR Measurement

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000285 | Samsung | Observation-1: Based on RAN1 conclusion, - In CMR only scenario, the RRC parameters timeRestrictionForChannelMeasurements can be configured. - In CMR+IMR scenario, timeRestrictionForChannelMeasurements and timeRestrictionForInterferenceMeasurements can be configured.Proposal-1: In CMR only scenario, M=1(single-shot measurement)shall be applied if * aperiodic CSI-RS resource is configured for channel measurement, or
* periodic or semi-persistent CSI-RS resource is configured for channel measurement and higher layer parameter timeRestrictionForChannelMeasurements is configured.

Proposal-2: In a single CSI-reportConfig with L1-SINR CMR+IMR measurement, the same measurement time restriction should be applied for CMR and IMR, i.e., both RRC signalling IE timeRestrictionForChannelMeasurements and timeRestrictionForInterferenceMeasurements should be configured or notConifgured. Proposal-3: In CMR+IMR scenario, M=1 (single-shot measurement) shall be applied if * aperiodic CSI-RS resource is configured for interference measurement (for SSB-based CMR or aperiodic CSI-RS based CMR), or
* periodic or semi-persistent CSI-RS resource is configured for channel and/or interference measurement and higher layer parameter timeRestrictionForChannelMeasurements or timeRestrictionForInterferenceMeasurements is configured.
	+ Note: by following Proposal-2, timeRestrictionForChannelMeasurements and timeRestrictionForInterferenceMeasurements shall both be configured in this case.

Proposal-4: For L1-SINR reporting with SSB based CMR and dedicated IMR configured, the measurement period requirements for FR1 and FR2 shall be defined as the below tables: Table x: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR1

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.  |

Table y: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR2

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.  |

Where the variable M, P, N are the same as Section 9.5.4.1 for L1-RSRP reporting. Proposal-5: For L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured, the measurement period requirements for FR1 and FR2 shall be defined as the below tables: Table x: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR1

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

Table y: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR2

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

Where the variable M, P, N are the same as Section 9.5.4.2 for L1-RSRP reporting. Observation-2: Two kinds of Type-D QCL are expected for a NZP CSI-RS resource (BM purpose), in following conditions:  - NZP CSI-RS resource configured as CMR in one CSI report (either L1-RSRP or L1-SINR) and IMR in another CSI report, where two corresponding CMRs are NOT Type-D QCLed; - NZP CSI-RS resource configured as IMR in two CSI reports, where two corresponding CMRs are NOT Type-D QCLed;In both cases, UE is not expected to conduct two measurements (for two CSI reports) on one NZP CSI-RS transmission instance.Proposal-6: For L1-SINR reporting with CMR + NZP-IMR configured in one CSI report, L1-SINR measurement requirements apply only if the NZP-IMR is not configured in another CSI report whose CMR is not Type-D QCLed; otherwise, longer measurement requirement is expected. Proposal-7: For L1-SINR measurement with dedicated configured NZP-IMR or ZP-IMR, there is no necessity to perform RX beam training/refinement for IMR. Proposal-8: For L1-SINR measurement with dedicated NZP-IMR, - “Repetition = On” may be configured if its CSI-RS resource set is used for the other BM purpose, e.g., some of CSI-RS resources within the CSI-RS resource set are used for CMR in another CSI reporting;- UE shall use NZP-IMR’s corresponding CMR’s TCI information for reception, and neglect any configuration by Repetition IE field for NZP-IMR’s CSI-RS resource set, i.e., “Repetition=On”, “Repetition=Off”, or Repetition field is not present. Proposal-9: For L1-SINR measurement with dedicated ZP-IMR,  - “Repetition” field should not be present for ZP-IMR’s CSI-RS resource set configuration. Proposal-10: Side condition for CMR+IMR scenario, in additional to L1-SINR lower bound (to be decided after simulation campaign), the accuracy requirement is applicable only if following conditions are satisfied: - Es/Iot over CMR: SSB or CSI-RS Es/Iot >=3dB and <=25dB - Es/Iot over NZP-IMR: CSI-RS Es/Iot >=3dB and <=25dB |
| R4-2000286 | Samsung | Observation 1: L1-SINR measurement in NZP-IMR scenarios (0 dB CMR/IMR side condition) is more accurate than ZP-IMR scenarios (-3 dB CMR/IMR side condition).Proposal 1: The side conditions are confirmed to achieve the ideal SINR as -3dB for both NZP and ZP scenarios, i.e.,  - For NZP-IMR: Side condition (SNR) on CMR and IMR are both 0dB - For ZP-IMR: Side condition (SNR) on CMR are -3dBProposal 2: It is proposed that the measurement period for L1-SINR as  - Single shot measurement (M=1): for single-shot scenarios (summarized in R4-2000285) - M=3: for other scenarios.  |
| R4-2000287 | Samsung | Reserved for L1-SINR measurement accuracy simulation result summary |
| R4-2000288 | Samsung | CR to TS38.133 on L1-SINR Measurement Requirement (Section 3.3 and 9) |
| R4-2000384 | Intel Corporation | Proposal 1: The measurement period for CMR only scenario can be re-used for CSI-RS based CMR+ZP-IMR scenario and CMR periodicity is used to define measurement period.Proposal 2: Not to define requirement for L1-SINR estimation if NZP-IM is configured as” repetition=ON”.Observation 1: there is no “repetition” configuration for ZP-IMR.Observation 2: The L1-SINR accuracy of CSI-RS based CMR only and CMR+ZP-IMR scenarios are similar. |
| R4-2000635 | CMCC | This contribution provides simulation results on L1-SINR based on the agreed simulation assumption. |
| R4-2000935 | MediaTek inc. | Proposal 1: UE does not expect that CMR and IMR are configured with different types of resource periodicity.Proposal 2: ZP-IMR is not required to configure as “repetition=ON” or “repetition=OFF”.Proposal 3 : The requirement for SSB based CMR and periodic ZP-IMR can be defined.Proposal 4: The requirement for NZP CSI-RS based CMR with “repetition = ON” and ZP-IMR can be defined, provided the QCL information of CMR is given.Proposal 5 : The requirement for NZP CSI-RS based CMR with “repetition = OFF” and ZP-IMR can be defined, provided the QCL information of CMR is given.Proposal 6 : SSB based CMR and NZP-IMR with “repetition = ON” is an error configuration and no requirement should be specified.Proposal 7 : The requirement for SSB based CMR and NZP-IMR with “repetition = OFF” can be defined, provided the QCL information of NZP-IMR is given.Proposal 8 : The requirement for NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = ON” can be defined, provided the QCL information of CMR is given.Proposal 9 : The requirement for NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = OFF” can be defined, provided the QCL information of CMR is given.Proposal 10 : NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = ON” is an error configuration and no requirement should be specified.Proposal 11: The requirement for NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = OFF” can be defined, provided the QCL information of CMR is given. |
| R4-2000936 | MediaTek inc. | Observation 1: For CMR totally overlapped with IMR, L1-SINR delay requirement can reuse L1-RSRP requirement.Proposal 1 : Evaluation time of L1-SINR is based on the maximum evaluation time between CMR and IMR. |
| R4-2000937 | MediaTek inc. | Proposal 1: For L1-SINR simulation assumption, the ZP-IMR should be corrected to CSI-IM.Proposal 2: For SSB based CMR L1- SINR for reporting, the absolute measurement accuracy is +/- 3.5 dB for FR1; +/- 3.5 dB for FR2 with side condition on CMR=-3dB.Proposal 3: For L1-SINR simulation assumption, the side condition on CMR across cases should be the same.Proposal 4: For SSB based CMR and NZP IMR L1-SINR for reporting, the absolute measurement accuracy is +/- 3.5 dB for FR1; +/- 3.5 dB for FR2 with side condition on CMR=-3dB and IMR=-3dB.Proposal 5: For SSB based CMR and ZP-IMR L1-SINR for reporting, the absolute measurement accuracy is +/- 3.5 dB for FR1; +/- 3.5 dB for FR2 with side condition on CMR=-3dB and IMR=-3dB.Proposal 6: For CSI-RS based CMR and NZP IMR L1- SINR for reporting, the absolute measurement accuracy is +/- 3.5 dB for FR1; +/- 3.5 dB for FR2 with side condition on CMR=-3dB and IMR=-3dB.Proposal 7: For CSI-RS based CMR and ZP-IMR L1- SINR for reporting, the absolute measurement accuracy is +/- 3.5 dB for FR1; +/- 3.5 dB for FR2 with side condition on CMR=-3dB and IMR=-3dB. |
| R4-2000997 | OPPO | draftCR on SS-SINR and CSI-SINR measurement report mapping (section 10.1.16.1) |
| R4-2001362 | Ericsson | Observation 1: No significant accuracy difference among different combinations of CMR and IMR. Proposal 1: Set the common measurement accuracy requirements for the L1-SINR with CMR-only, SSB + NZP-IMR, SSB + ZP-IMR, CSI-RS + NZP-IMR and CSI-RS + ZP-IMR. Proposal 2: Set the assumed number of samples for L1-SINR measurements to 3 if the case the measurement restriction is not configured. Proposal 3: Set both the assumed number of CMR samples for L1-SINR measurements (MCMR) and IMR samples for L1-SINR measurements (MIMR) to 1 if the higher layer parameter *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* is configured.Proposal 4: L1-SINR measurement period is set for FR1 as follows:

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period (ms) |
| Non-DRX | max(TReport, cell(M\*P)\*max(TCMR, TIMR)) |
| DRX cycle <= 320 ms | max(TReport, cell(1.5\*M\*P)\*max(TDRX, TCMR, TIMR)) |
| DRX cycle > 320 ms | cell(M\*P)\*TDRX |
| P: Measurement gap factor.TReport, CSI reporting period. |

 In the case of FR2, the measurement period is scaled with N as same as L1-RSRP.  |
| R4-2001578 | Huawei, HiSilicon | Proposal 1: The measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_w/\_IMR for L1-SINR reporting with SSB based CMR and dedicated IMR configured could be defined as follows:Table 1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB\_CMR\_w/\_IMR for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_CMR\_w/\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured as CMR for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. |

Table 2: Measurement period TL1-RSRP\_Measurement\_Period\_SSB\_CMR\_w/\_IMR for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_CMR\_w/\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured as CMR for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. |

Proposal 2: The measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_w/\_IMR for L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured could be defined as follows:Table 3: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS\_CMR\_w/\_IMR for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS\_CMR\_w/\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured as CMR for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured as CMR for L1-SINR measurement is transmitted with Density = 3. |

Table 4: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS\_CMR\_w/\_IMR for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS\_CMR\_w/\_IMR (ms)  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured as CMR for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured as CMR for L1-SINR measurement is transmitted with Density = 3. |

Proposal 3: For CMR+IMR scenario, the variable M used to define L1-SINR measurement period could be defined as follows:* M=1, if higher layer parameter timeRestrictionForChannelMeasurement or timeRestrictionForInterferenceMeasurements is configured;
* M=3, otherwise.

Proposal 4: For CMR+IMR scenario, the variable P used for defining L1-SINR measurement period could be determined by the ratio of available L1-SINR measurement occasions.* A L1-SINR measurement occasion is considered as available only when the CMR and the associated IMR are both non-overlapped with measurement gap or SMTC window.

Proposal 5: For CMR+IMR scenario, the variable N used for defining L1-SINR measurement period could be defined as 8 when SSB is configured as CMR.Proposal 6: For CMR+IMR scenario, when CSI-RS is configured as CMR, RAN4 need to investigate how to utilize the QCL information of CMR and IMR for UE perform L1-SINR measurements. |
| R4-2001579 | Huawei, HiSilicon | Observation 1: In Rel-15, only the CSI-RS resource sets for L1-RSRP reporting can be configured with repetition.Observation 2: There is neither repetition configuration nor QCL configuration for a ZP-CSI-RS resource.Observation 3: When a CSI-RS resource with repetition configuration is configured as CMR or IMR for L1-SINR measurement, then the L1-SINR measurement occasions will be always overlapped with the L1-RSRP measurement occasions.Proposal 1: For CMR+IMR scenario, RAN4 study when the measurement restrictions need to be applied between L1-SINR measurement and L1-RSRP measurements.Proposal 2: For CMR and IMR scenario, RAN4 study the configuration restrictions between CMR and IMR. |
| R4-2002120 | Qualcomm | Observation 1: Table 1 shows the statistics of L1-SINR simulation results in different scenarios.Table 1: Statistics of L1-SINR simulation results in different scenarios

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCS | # samples | Mean [dB] | CMR only | SSB/NZP IMR | SSB/ZP IMR | CSI-RS/NZP IMR | CSI-RS/ZP IMR |
| CMR only | SSB/NZP | SSB/ZP | CSI-RS/NZP | CSI-RS/ZP | 5-perc. | 95-perc. | 5-perc. | 95-perc. | 5-perc. | 95-perc. | 5-perc. | 95-perc. | 5-perc. | 95-perc. |
| 15 | 1 | -1.33 | -3.3 | -3.35 | -2.9 | -3 | -2.69 | 0.12 | -4.1 | -2.6 | -4.34 | -2.45 | -3.62 | -2.19 | -3.87 | -2.17 |
| 3 | -1.39 | -3.31 | -3.35 | -2.9 | -3 | -2.17 | -0.53 | -3.77 | -2.83 | -3.95 | -2.79 | -3.31 | -2.47 | -3.48 | -2.53 |
| 5 | -1.4 | -3.31 | -3.36 | -2.91 | -3.01 | -1.99 | -0.74 | -3.64 | -3 | -3.79 | -2.97 | -3.24 | -2.6 | -3.37 | -2.66 |
| 30 | 1 | -1.35 | -2.76 | -3.17 | -2.82 | -3.18 | -2.76 | 0.16 | -3.77 | -1.89 | -4.15 | -2.29 | -3.48 | -2.15 | -4.01 | -2.36 |
| 3 | -1.41 | -2.76 | -3.18 | -2.82 | -3.18 | -2.26 | -0.55 | -3.32 | -2.26 | -3.73 | -2.58 | -3.22 | -2.43 | -3.66 | -2.71 |
| 5 | -1.42 | -2.76 | -3.18 | -2.83 | -3.19 | -2.07 | -0.76 | -3.18 | -2.38 | -3.65 | -2.76 | -3.12 | -2.51 | -3.55 | -2.83 |
| 120 | 1 | -1.41 | -2.89 | -3.48 | -2.55 | -3.23 | -3 | 0.15 | -3.94 | -1.91 | -5.03 | -2.16 | -3.22 | -1.84 | -4.17 | -2.41 |
| 3 | -1.5 | -2.89 | -3.48 | -2.55 | -3.24 | -2.79 | -0.56 | -3.49 | -2.34 | -4.43 | -2.72 | -3.33 | -2.09 | -4.04 | -2.71 |
| 5 | -1.51 | -2.9 | -3.48 | -2.55 | -3.24 | -2.51 | -0.82 | -3.37 | -2.45 | -4.15 | -2.84 | -3.08 | -2.18 | -3.79 | -2.82 |

Observation 2: If CMR is configured with “repetition = ON”, UE will have to sweep its RX beams to receive CMR. UE should use the same set of RX beams to receive NZP-IMR as well because the level of interference may vary across its different RX beams. Observation 3: If CMR and NZP-IMR are configured with repetition pattern = “ON”, they should be located in non-overlapping symbols so that UE can change its RX beams in time domain appropriately to receive CMR and NZP-IMR signals. Observation 4: If the L1-SINR becomes very high in CMR + NZP-IMR scenarios, UE will not be able to adapt its RX gain controller properly to receive CMR and NZP-IMR.Proposal 1: RAN4 uses the following table to define the estimation accuracy requirements of L1-SINR.Table: L1-SINR estimation accuracy (in dB) in different scenarios

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| SCS | # samples | CMR only | SSB/NZP IMR | SSB/ZP IMR | CSI-RS/NZP IMR | CSI-RS/ZP IMR |
| 15 | 1 | $$\pm 4$$ | $$\pm 2$$ | $$\pm 2$$ | $$\pm 1.5$$ | $$\pm 1.5$$ |
| 3 | $$\pm 3$$ | $$\pm 1.5$$ | $$\pm 1.5$$ | $$\pm 1.5$$ | $$\pm 1$$ |
| 5 | $$\pm 3$$ | $$\pm 1.5$$ | $$\pm 1.5$$ | $$\pm 1$$ | $$\pm 1$$ |
| 30 | 1 | $$\pm 4$$ | $$\pm 2$$ | $$\pm 2$$ | $$\pm 1.5$$ | $$\pm 2$$ |
| 3 | $$\pm 3$$ | $$\pm 1.5$$ | $$\pm 1.5$$ | $$\pm 1.5$$ | $$\pm 1.5$$ |
| 5 | $$\pm 3$$ | $$\pm 1.5$$ | $$\pm 1.5$$ | $$\pm 1$$ | $$\pm 1.5$$ |
| 120 | 1 | $$\pm 4$$ | $$\pm 2$$ | $$\pm 3$$ | $$\pm 2$$ | $$\pm 2$$ |
| 3 | $$\pm 3$$ | $$\pm 1.5$$ | $$\pm 2$$ | $$\pm 1.5$$ | $$\pm 2$$ |
| 5 | $$\pm 3$$ | $$\pm 1.5$$ | $$\pm 2$$ | $$\pm 1.5$$ | $$\pm 1.5$$ |

Proposal 2: ZP-IMR CSI-RS can be configured with “repetition = off” in FR2.Proposal 3: NZP-IMR CSI-RS can be configured with both “repetition = off” or “repetition = on” in FR2.* CMR and NZP-IMR should be configured with the same repetition pattern.
* CMR and NZP-IMR should not overlap in time domain if they are configured with “repetition = on”.

Proposal 4: In CMR + ZP-IMR scenarios, Es/IoT of CMR should range between -3 and 25 dB.Proposal 5: In CMR + NZP-IMR scenarios, both Es/IoT of CMR and IoT of NZP-IMR should range between 0 and 25 dB. the resultant SINR in this scenario, i.e., the ratio of CMR over NZP-IMR should also range between -3 to 25 dB. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1: L1-SINR Measurement Period

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1: Applicable condition(s) for one-shot L1-SINR measurement report for CMR only scenario:**

* Applicable condition(s) for CMR only scenario:
	+ Option 1: M=1 shall be applied if
		- aperiodic CSI-RS resource is configured for channel measurement, or
		- periodic or semi-persistent CSI-RS resource is configured for channel measurement and higher layer parameter *timeRestrictionForChannelMeasurements* is configured.
* Recommended WF
	+ Suggest RAN4 to agree on Option 1.

**Issue 1-1-2: Restriction between measurement time restriction on IMR and CMR:**

* Restriction between measurement time restriction on IMR and CMR:
	+ Option 1: In a single *CSI-reportConfig* with L1-SINR CMR+IMR measurement, the same measurement time restriction should be applied for CMR and IMR, i.e., both RRC signalling IE *timeRestrictionForChannelMeasurements* and *timeRestrictionForInterferenceMeasurements* should be configured or notConfigured:
	+ Option 2: No restriction applied.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-1-3: Applicable condition(s) for one-shot L1-SINR measurement report for CMR+IMR scenario:**

* Applicable condition(s) for CMR+IMR scenario:
	+ Option 1: M=1 shall be applied if
		- aperiodic CSI-RS resource is configured for interference measurement (for SSB-based CMR or aperiodic CSI-RS based CMR), or
		- periodic or semi-persistent CSI-RS resource is configured for channel and/or interference measurement and higher layer parameter *timeRestrictionForChannelMeasurements* **or** *timeRestrictionForInterferenceMeasurements* is configured.
	+ Option 1a: M=1 shall be applied if
		- aperiodic CSI-RS resource is configured for interference measurement (for SSB-based CMR or aperiodic CSI-RS based CMR), or
		- periodic or semi-persistent CSI-RS resource is configured for channel and/or interference measurement and higher layer parameter *timeRestrictionForChannelMeasurements* **or** *timeRestrictionForInterferenceMeasurements* is configured.
			* Note: timeRestrictionForChannelMeasurements and timeRestrictionForInterferenceMeasurements shall both be configured in this case if above Issue 1-1-2 option 1 is agreed.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-1-4: Measurement period for SSB-based CMR+IMR scenario:**

* Proposals:
	+ Option 1: By following L1-RSRP measurement requirement and restricting CMR and IMR’s 1-to-1 mapping, measurement period requirements for FR1 and FR2 shall be defined as:

**Table x: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.  |

**Table y: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.  |

Where the variable M, P, N are the same as Section 9.5.4.1 for L1-RSRP reporting.

* + Option 1a: similar to above Option 1, but define P as determined by the ratio of available L1-SINR measurement occasions over all occasions.
		- A L1-SINR measurement occasion is considered as available only when the CMR and the associated IMR are non-overlapped with measurement gap or SMTC window.
	+ Option 2: similar to above option 1, but replace TSSB by max(TSSB, TIMR).
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-1-5: Measurement period for CSI-RS-based CMR+IMR scenario:**

* Proposals:
	+ Option 1: By following L1-RSRP measurement requirement and restricting CMR and IMR’s 1-to-1 mapping, measurement period requirements for FR1 and FR2 shall be defined as:

**Table x: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

**Table y: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

Where the variable M, P, N are the same as Section 9.5.4.2 for L1-RSRP reporting.

* + Option 1a: similar to above Option 1, but define P as determined by the ratio of available L1-SINR measurement occasions over all occasions.
		- A L1-SINR measurement occasion is considered as available only when the CMR and the associated IMR are non-overlapped with measurement gap or SMTC window.
	+ Option 2: similar to above option 1, but replace TCSI-RS by max(TCSI-RS, TIMR).
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-1-6: Side condition for measurement accuracy:**

* In last meeting, the assumption for measurement accuracy evaluation is agreed.
* Proposals:
	+ Option 1: -3dB for ideal SINR as -3dB
		- For NZP-IMR: Side condition (SNR) on CMR and IMR are both 0dB
		- For ZP-IMR: Side condition (SNR) on CMR are -3dB.
	+ Option 2: the side condition on CMR across cases should be the same.
		- For NZP-IMR: Side condition (SNR) on CMR and IMR are both -3dB, target SINR is -4.77dB
		- For ZP-IMR: Side condition (SNR) on CMR are -3dB.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-1-7: Number of Samples for L1-SINR Measurement:**

* Based on the summary of measurement accuracy (reserved in R4-2000287), the number of samples can be decided to achieve certain measurement accuracy.
* Proposals:
	+ Option 1: Common accuracy requirement M = [3] if single shot measurement is not applicable for CMR-only, SSB+NZP-IMR, SSB+ZP-IMR, CSI-RS+NZP-IMR and CSI-RS+ZP-IMR.
* Recommended WF
	+ Suggest RAN4 to agree on Option 1.

**Issue 1-1-8: Number of Scaling for FR2 (value of N)**

* Proposals:
	+ Option 1: the measurement period is scaled with N defined as same as L1-RSRP.
* Recommended WF
	+ Suggest RAN4 to agree on Option 1.

### Sub-topic 1-2: Measurement Restriction and Scheduling Availability

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-2-1:** **NZP-IMR: QCL indication**

* Proposals for QCL indication for NZP-IMR:
	+ Option 1: For L1-SINR reporting with CMR + NZP-IMR configured in one CSI report, L1-SINR measurement requirements apply only if the NZP-IMR is not configured in another CSI report whose CMR is not Type-D QCLed; otherwise, longer measurement requirement is expected.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-2-2: NZP-IMR: “repetition = on”**

* For CSI-RS configured as NZP-IMR in FR2, whether “repetition = on” is configurable:
	+ Option-1: NZP-IMR can be configured with “repetition = off” or “repetition = on”:
		- Not to define requirement for L1-SINR estimation if NZP-IM is configured as “repetition=ON”.
	+ Option-2: NZP-IMR can be configured with “repetition = off” or “repetition = on” if the CSI-RS resource set is used for the other purpose than this L1-SINR measurement report:
		- RX beam for NZP-IMR shall follow CMR, i.e., same RX filter shall be used.
	+ Option-3: NZP-IMR can be configured with “repetition = off” or “repetition = on”:
		- CMR and NZP-IMR should be configured with the same repetition pattern.
		- CMR and NZP-IMR should not overlap in time domain if they are configured with “repetition = on”.
	+ Option-4: Depending on scenarios (i.e., configuration restriction):
		- SSB based CMR and NZP-IMR with “repetition = ON” is error configuration;
		- SSB based CMR and NZP-IMR with “repetition = OFF” is correct configuration;
		- NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = ON” is correct configuration;
		- NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = OFF” is correct configuration;
		- NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = ON” is error configuration;
		- NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = OFF” is correct configuration.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-2-3:** **ZP-IMR: “repetition = on”**

* For CSI-RS configured as ZP-IMR in FR2, whether “repetition = on” is configurable:
	+ Option 1: “Repetition” field should not be present for ZP-IMR’s CSI-RS resource set configuration.
	+ Option 2: ZP-IMR CSI-RS can be configured with “repetition = off” in FR2.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-2-4:** **Measurement restriction between L1-SINR and L1-RSRP**

* Proposals:
	+ Option 1: For CMR+IMR scenario, RAN4 study when the measurement restrictions need to be applied between L1-SINR measurement and L1-RSRP measurements.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion since it is first time proposed.

### Sub-topic 1-3: Side Condition for Es/Iot

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-3-1: L1-SINR measurement side condition for Es/Iot for CMR+ZP-IMR**

* Proposals for Es/Iot on CMR:
	+ Option 1: SSB or CSI-RS Es/Iot >= -3dB and <=25dB
* Recommended WF
	+ Suggest RAN4 to agree on Option 1.

**Issue 1-3-2: L1-SINR measurement side condition for Es/Iot for CMR+NZP-IMR**

* Proposals for Es/Iot on CMR and NZP-IMR:
	+ Option 1: Es/Iot >= -3dB and <=25dB
	+ Option 2: Es/Iot >=0dB and <=25dB.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 1-3-3: Clarification on ZP-IMR configuration**

* Proposals for ZP-IMR configuration:
	+ Option 1: ZP CSI-RS (as agreed in the simulation assumption in the last meeting)
	+ Option 2: CSI-IM (to align with RAN1 specification)

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | Sub topic 1-1: (2/25)Issue 1-1-1:We agree the option 1. Because, in CMR only case, the L1-SINR configuration is similar to L1-RSRP, the applicable conditions for CMR only case can reuse L1-RSRP.Issue 1-1-2:We agree the option 1. Due to CMR and IMR shall be 1-to-1 mapped, we agree that the restriction between measurement time restriction on IMR and CMR should be both configured.Issue 1-1-3:We agree option-1a (i.e. option 1 with note) because *timeRestrictionForChannelMeasurements* and *timeRestrictionForInterferenceMeasurements* shall be configured at the same time or not configured simultaneously. However, the wording could be further revised. E.g. * M=1 while signling *timeRestrictionForChannelMeasurements* **and** *timeRestrictionForInterferenceMeasurements* are configured.

Issue 1-1-4:We propose option-1a, which the P factor of IMR should be also taken in to account, while only P factor of CMR (SSB) was taken in to account in option 1.The P sharing factor might be different for CMR and IMR, i.e. in some case CMR is overlapped with SMTC or MG but IMR is non-overlapped with SMTC or MG. On the other hand, option-2 is not aligned with agreed WF, where CMR and IMR periodicity shall be identical.Issue 1-1-5:We propose option-1a, which the P factor of IMR should be also taken in to account, while only P factor of CMR (CSI-RS) was taken in to account in option 1.The P sharing factor might be different for CMR and IMR, i.e. in some case CMR is overlapped with SMTC or MG but IMR is non-overlapped with SMTC or MG. On the other hand, option-2 is not aligned with agreed WF, where CMR and IMR periodicity shall be identical.Issue 1-1-6:We propose option-2, the side condition on CMR across cases should be aligned, because the higher side condition on CMR has a better accuracy performance.Issue 1-1-7:* For performance part, which can be discussed in the next meeting, the measurement accuracy should be based on one sample accuracy as the worst case, as L1-RSRP approach.
* For core part requirement, we support M=3 for the measurement period, if single shot measurement is not applicable.

Issue 1-1-8:We agree option-1, the parameter N for L1-SINR can reuse L1-RSRP.Sub topic 1-2: (2/25)Issue 1-2-1:More discussion is needed. This sentence “L1-SINR measurement requirements apply only if the NZP-IMR is not configured in another CSI report **whose CMR is not Type-D QCLed**” is unclear. We have the following questions for clarifications:* Q1: Which RS/channel should be the CMR QCLed to?
* Q2: if the CMR is SSB, which has no TCI state, how to determine it is QCLed or not?
* Q3: if the NZP-IMR is not configured in another CSI report, should the requirements apply?

Clarification would be needed. Could we try to agree on some high-level principles first, e.g. * CMRs in 2 reports should be Type-D QCLed, if the same NZP IMR is configured.
* CMR and IMR should be Type-D QCLed in one report. (as RAN1 agreement)
	+ It addresses the case that NZP CSI-RS is configured as CMR in one report and configured as IMR in other report, since all the CMR/IMR in two reports are QCLed.

Issue 1-2-2: We propose option-4, where NZP-IMR with “repetition = ON” can be configured only if the CMR is NZP CSI-RS resource set with “repetition = ON” The justification as follows:* SSB based CMR and NZP-IMR with “repetition = ON” is an error configuration. According to RAN1 agreement, CMR and IMR shall be 1-to-1 mapped. However, different SSB implies different Tx beam direction, which is conflict with the assumption of “repetition=ON”, when UE assumes the same TX are applied.
* On the other hand, NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = ON” is also an error configuration. In order to refine UE Rx beam, NW will configure Tx beam as repetition=ON. As a result, IMR should not be a target for UE refining Rx beam.

Issue 1-2-3:We support option-1, ZP-IMR should be CSI-IM, not ZP CSI-RS, and it has no “repetition” field.Issue 1-2-4:We agree option-1 that RAN4 study when the measurement restrictions need to be applied between L1-SINR measurement and L1-RSRP measurements for CMR+IMR scenario.Sub topic 1-3: (2/25)Issue 1-3-1:We agree option-1, SSB or CSI-RS Es/Iot >=-3dB and <=25dB. In order to align the side condition on CMR among different cases.Issue 1-3-2:We agree option-1, SSB or CSI-RS Es/Iot >=-3dB and <=25dB. In order to align the side condition on CMR among different cases.Issue 1-3-3:We propose option-2. We have one thing to highlight is the simulation assumption on ZP-IMR. The ZP-IMR configuration should be CSI-IM, rather than ZP CSI-RS, as in RAN1 specification. * **L1-SINR accuracy evaluation simulation assumption for SSB-based CMR + ZP-IMR:**

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| SCS | 15kHz (FR1), 30kHz (FR1), 120kHz (FR2)  |
| Channel measurement resource (CMR) | SSB |
| Interference measurement resource (IMR) configuration | **CSI-RS  // [MTK] should be CSI-IM, not ZP CSI-RS** |

 |
| Samsung  | Sub-topic 1-1: L1-SINR Measurement Period* Issue 1-1-1: Option 1;
* Issue 1-1-2: Option 1 (the same time measurement restriction applied for CMR and IMR);
* Issue 1-1-3: Option 1a (since option 1 and 1a are similar, and depends on Issue 1-1-2)
* Issue 1-1-4: Option 1 (The fact is correct that P sharing factor might be different for CMR and IMR, as mentioned in MTK’s paper, however we have concern on Option 1a since it could make the specification even more complex. Another way to solve this is by adding assumption to make CSI-IM not overlapped with MG or SMTC.)
* Issue 1-1-5: Option 1 (similar to above issue)
* Issue 1-1-6: Option 1 (Because option 1 is last meeting’s assumption for simulation. Without following existing simulation assumption, more meeting cycles will be needed to align with measurement accuracy. Besides that, the issue for different CMR SNR is already considered in last meeting. )
* Issue 1-1-7: Option 1 (Further check based on the measurement result summary)
* Issue 1-1-8: Option 1 (straightforward to reuse FR2 scaling number for L1-RSRP);

Sub-topic 1-2: Measurement Restriction and Scheduling Availability* Issue 1-2-1: Option 1 (Prefer to use Option 1 as restriction)
* Issue 1-2-2: Option 2 (i.e., additional QCL relationship restriction is not needed if RAN4 assume RX beam for NZP-IMR shall always follow CMR, i.e., same RX filter shall be used. )
* Issue 1-2-3: Option 1 (Based on latest RAN1 spec, CSI-IM used for ZP-IMR)
* Issue 1-2-4: Need further study on this issue by considering detailed scenario.

Sub-topic 1-3: Side condition for Es/Iot* Issue 1-3-1: Option 1 (Similar to L1-RSRP)
* Issue 1-3-2: Option 1 (for CMR + dedicated configured NZP-IMR, the same condition for Es/Iot on CMR and NZP-IMR should be applied as L1-RSRP measurement)
* Issue 1-3-3: Option 2 (aligned with RAN1, but the change of this will not have impact on measurement accuracy evaluation, but impact on CR drafting)
 |

|  |  |
| --- | --- |
| Qualcomm | **Sub-topic 1-1:**Issue 1-1-1: support option 1.Issue 1-1-2: support option 1.Issue 1-1-3: If option 1 of issue 1-1-2 gets agreed, aren’t option 1 and option 1a of issue 1-1-3 same? Propose to decide this in the 2nd round after issue 1-1-2 gets agreed.Issue 1-1-4: support option 1 except the value of P. We propose to keep the value of P to be FFS for this meeting.Issue 1-5: support option 1 except the value of P. We propose to keep the value of P to be FFS for this meeting.Issue 1-6: support the SNR values that are mentioned in option 1 but not sure what “-3 dB for ideal SINR as -3 dB” means. Does it mean that accuracy requirement should also be +- 3 dB? That won’t be agreeable to us at this point because it depends on the number of samples and scenarios.Issue 1-7: Does option 1 only mean that 3 samples will be used to define accuracy requirement across all scenarios? This is agreeable to us. However, does option 1 also mean that the same level of accuracy requirement, in terms of dB, will be defined for all scenarios. That is not agreeable to us at this point.Issue 1-8: Support option 1. **Sub-topic 1-2:**Issue 1-2-1: support option 1.Issue 1-2-2: support option 3.Issue 1-2-3: Option 2 is a bit ambiguous. In their current written forms, option 1 and 2 seem similar. We think that ZP-IMR should only be configured with “repetition = off”. Repetition = ON should not be allowed for ZP-IMR.Issue 1-2-4: In our understanding, this issue has been brought up just in this meeting. This should be kept FFS during this meeting and revisited in the next meeting.**Sub-topic 1-3:**Issue 1-3-1: Support option 1.Issue 1-3-2: Support option 2 but an additional condition should be set. To derive side conditions, the resultant L1-SINR should also lie between -3 dB and 25 dB. Issue 1-3-3: We propose this to be discussed in the 2nd round or in the next meeting. |
| Intel | **Sub topic 1-1:**Issue 1-1-1: agree with option 1.Issue 1-1-2: agree with option 1.Issue 1-1-3: agree with option 1b.Issue 1-1-4: The sharing factor may be different for CMR and IMR as their time domain locations are different when they are conflict with MG and SMTC. It seems that CMR and IMR may not be conducted simultaneously in some cases. How to define requirement in this scenario?Issue 1-1-5: the same as that of Issue 1-1-4.Issue 1-1-6: needs more clarification about how to simulate about CMR+NZP-IMR. For NZP-IMR, what kind of signal is transmitted on IMR, will it be interference signal from the serving cell plus noise? All the signal on the IMR be counted as interference? The side condition is INR not SNR?Issue 1-1-7: no matter if single slot measurement is applicable or not, accuracy should be defined based on single slot. Issue 1-1-8: agree with option 1.**Sub topic 1-2:** Issue 1-2-1: agree with option 1.Issue 1-2-2: agree with option 4. Issue 1-2-3: agree with option 1. |
| Huawei | Sub topic 1-1:Issue 1-1-1:We can to agree on option 1Issue 1-1-2:We can to agree on option 1. However, we suggest that RAN4 shall align with RAN1’s design on this restriction.Issue 1-1-3:We can agree on option 1a if the restriction between measurement time restriction on IMR and CMR is agreed.Issue 1-1-4:We propose option 1a.Issue 1-1-5:We propose option 1a, but the variable N needs to be FFS.Issue 1-1-6:We propose option 2. For CMR+IMR scenarios, the measurement uncertainty of L1-SINR is mainly from the measurement error on CMR. We suggest to evaluate L1-SINR measurement accuracy under the same side condition of CMR for both ZP-IMR and NZP-IMR.Issue 1-1-7:We can to agree on option 1.Issue 1-1-8:For the cases of CMR only, SSB+IMR, CSI-RS+ZP-IMR, we can agree on option 1. The variable N can be defined as same as L1-RSRP. For the case of CSI-RS+NZP-IMR, The variable N needs to be FFS.Sub topic 1-2:Issue 1-2-1:We can agree on option 1.Issue 1-2-2:We agree whether CSI-RS with“repetition = on” is configurable as NZP-IMR depends on scenarios. We are fine with option4. Issue 1-2-3:We propose option 1.Issue 1-2-4:We propose option 1 to encourage companies to study the confliction between L1-SINR measurement and L1-RSRP measurement.Sub topic 1-3:Issue 1-3-1:We can to agree on option 1.Issue 1-3-2:We propose option 1. |
| Ericsson | **Sub topic 1-1**Issue 1-1-2: We prefer option 2. We are fine to set requirements when gNB configures both *timeRestrictionForChannelMeasurements* **and** *timeRestrictionForInterferenceMeasurements*. However, there is ambiguity in case NW configures either *timeRestrictionForChannelMeasurements* or *timeRestrictionForInterferenceMeasurements*. Therefore our proposal is to apply M=1 (related to 1-1-3) if gNB configures channel measurement restriction **and/or** interference measurement restriction.For reference we put the table in our paper R4-2001362.

|  |  |  |
| --- | --- | --- |
|  |  | CMR measurement restriction(timeRestrictionForChannelMeasurement) |
|  |  | Not configured | Configured |
| IMR measurement restriction(timeRestrictionForInterferenceMeasurements) | Not configured | MCMR=3, MIMR=3 | MCMR=1, MIMR=1 |
| Configured | MCMR=1, MIMR=1 | MCMR=1, MIMR=1 |

Issue 1-1-3: We prefer option 1. Same comment as 1-1-2 above. RAN4 should clarify the UE behavior for the combination of *timeRestrictionForChannelMeasurements* = on/off and *timeRestrictionForInterferenceMeasurements* = on/off. Issue 1-1-4: We prefer option 2: As we proposed in our paper, CMR and IMR should be 1-to-1 mapped, but each associated CMR and IMR could be configured with the different transmission periodicity, according to RAN1 agreement. Therefore we propose to replace TSSB with max(TSSB, TIMR). If RAN4 requirements are based on the same period of TSSB and TIMR, it is the limitation for the network. Issue 1-1-5: We prefer option 2. Same reason as 1-1-4.Issue 1-1-6: We prefer option 1. We want to set the target SINR to -3dB. Issue 1-1-7: Agree with option 1.**Sub topic 1-2:**Issue 1-2-4: In our understanding, gNB can configure channel measurement restriction and interference measurement restriction for L1-SINR and L1-RSRP independently. We think UE should follow each CSI reporting configuration by gNB. **Sub topic 1-3:**Issue 1-3-2: Related to 1-1-5. We prefer to option 2. |
| Nokia, Nokia Shanghai Bell | **Sub-topic 1-1:**Issue 1-1-1: No strong view.Issue 1-1-3: No major differences between options 1 and 1a. Further clarifications are needed. Issue 1-1-4: Option 1 or 2 is OK. Issue 1-1-5: Option 1 or 2 is OK.Issue 1-1-7: Option 1 is OK but L1-SINR measurement accuracy should be evaluated. So, “[]” should be kept until the accuracy is evaluated. Issue 1-1-8: No strong view.**Sub-topic 1-3:**Issue 1-3-3: RAN4 should follow RAN1 decisions. So, option 2 is OK. |
| DCM | Issue 1-1-1: Applicable condition(s) for one-shot L1-SINR measurement report for CMR only scenario:Agree with option 1 |

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2000997 | MTK: OK. |
| Samsung: we suggest Chair to endorse the editorial change in this draft CR, which can be combined with R4-1915607 which has been endorsed in Reno meeting.  |
|  |
| R4-2000288 | MTK: We cannot agree this CR now. It should be based on conclusion of open issue discussion such as issue 1-1-4 . |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1-1** | *Issue 1-1-1: Applicable condition(s) for one-shot L1-SINR measurement report for CMR only scenario:** Option 1 (MTK, Samsung, Qualcomm, Intel, Huawei, DCM): M=1 shall be applied if
	+ aperiodic CSI-RS resource is configured for channel measurement, or
	+ periodic or semi-persistent CSI-RS resource is configured for channel measurement and higher layer parameter *timeRestrictionForChannelMeasurements* is configured.

*Tentative agreements:**Applicable condition(s) for one-shot L1-SINR measurement report for CMR only scenario:** M=1 shall be applied if
	+ aperiodic CSI-RS resource is configured for channel measurement, or
	+ periodic or semi-persistent CSI-RS resource is configured for channel measurement and higher layer parameter *timeRestrictionForChannelMeasurements* is configured.

*Recommendations for 2nd round: N/A* |
| *Issue 1-1-2: Restriction between measurement time restriction on IMR and CMR:** Option 1 (MTK, Samsung, Qualcomm, Intel, Huawei): In a single *CSI-reportConfig* with L1-SINR CMR+IMR measurement, the same measurement time restriction should be applied for CMR and IMR, i.e., both RRC signalling IE *timeRestrictionForChannelMeasurements* and *timeRestrictionForInterferenceMeasurements* should be configured or notConfigured:
* Option 2 (Ericsson): No restriction applied.

*Tentative agreements: Suggest to follow option 1 as major view, i.e,* *Restriction between measurement time restriction on IMR and CMR:** In a single *CSI-reportConfig* with L1-SINR CMR+IMR measurement, the same measurement time restriction should be applied for CMR and IMR, i.e., both RRC signalling IE *timeRestrictionForChannelMeasurements* and *timeRestrictionForInterferenceMeasurements* should be configured or notConfigured:

*Recommendations for 2nd round: If above tentative agreement is not achieved in 1st round, suggest companies to consider the M=1 or 3 applicability table provided by Ericsson.*  |
| *Issue 1-1-3: Applicable condition(s) for one-shot L1-SINR measurement report for CMR+IMR scenario:** Option 1 (Ericsson): M=1 shall be applied if
	+ aperiodic CSI-RS resource is configured for interference measurement (for SSB-based CMR or aperiodic CSI-RS based CMR), or
	+ periodic or semi-persistent CSI-RS resource is configured for channel and/or interference measurement and higher layer parameter *timeRestrictionForChannelMeasurements* **or** *timeRestrictionForInterferenceMeasurements* is configured.
* Option 1a (MTK, Samsung, Intel, Huawei, ): M=1 shall be applied if
	+ aperiodic CSI-RS resource is configured for interference measurement (for SSB-based CMR or aperiodic CSI-RS based CMR), or
	+ periodic or semi-persistent CSI-RS resource is configured for channel and/or interference measurement and higher layer parameter *timeRestrictionForChannelMeasurements* **or** *timeRestrictionForInterferenceMeasurements* is configured.
		- Note: timeRestrictionForChannelMeasurements and timeRestrictionForInterferenceMeasurements shall both be configured in this case if above Issue 1-1-2 option 1 is agreed.

*[Moderator] Clarification on the difference between Option 1 and Option 1a:* * *Option 1a shall be followed if above option 1 for Issue 1-1-2 can be agreed.*

*Tentative agreements: If option 1 is agreed for Issue 1-1-2, Option 1a should be agreeable.* *Recommendations for 2nd round: If above tentative agreement is not achieved in 1st round, continue discussion.*  |
| *Issue 1-1-4: Measurement period for SSB-based CMR+IMR scenario:** + Option 1 (Samsung, Nokia): By following L1-RSRP measurement requirement and restricting CMR and IMR’s 1-to-1 mapping, measurement period requirements for FR1 and FR2 shall be defined as:

**Table x: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.  |

**Table y: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.  |

Where the variable M, P, N are the same as Section 9.5.4.1 for L1-RSRP reporting. * + Option 1a (MTK, Huawei): similar to above Option 1, but define P as determined by the ratio of available L1-SINR measurement occasions over all occasions.
		- A L1-SINR measurement occasion is considered as available only when the CMR and the associated IMR are non-overlapped with measurement gap or SMTC window.
	+ Option 1b (Samsung): same as above Option 1, but adding assumption to make CSI-IM not overlapped with MG or SMTC.
	+ Option 1c (Qualcomm, Samsung): same as above Option 1, but FFS the value of P.
	+ Option 2 (Ericsson, Nokia): similar to above option 1, but replace TSSB by max(TSSB, TIMR).

*[Moderator] No clear majority view. Considering the difference among Option 1, 1a, 1b, and 1c comes from how to treat P values, which could be different for CMR and IMR, we suggest to use 1c as a compromise and further discuss P value in next meeting. Not quite sure Option 1c can be regarded as majority view.* *[Moderator] For Option 2, it is somehow contradicting to existing agreement as below from approved WF [R4-1915850], i.e.,*

|  |
| --- |
| * **For L1-SINR measurement report with averaging over multiple shot for CMR+IMR scenario**
	+ CMR+IMR scenario (SSB-based CMR + IMR, and CSI-RS-based CMR+IMR):
		- In RAN4 requirement, only CMR periodicity = IMR periodicity is assumed;
	+ Measurement period: For L1-SINR measurement report with averaging over multiple shot for CMR+IMR scenario
		- only using CMR periodicity to define measurement period
 |

*Tentative agreements: N/A.* *Recommendations for 2nd round: Discuss Option 1c as a compromise proposal for this meeting.*  |
| *Issue 1-1-5: Measurement period for CSI-RS-based CMR+IMR scenario:** + Option 1 (Samsung, Nokia): By following L1-RSRP measurement requirement and restricting CMR and IMR’s 1-to-1 mapping, measurement period requirements for FR1 and FR2 shall be defined as:

**Table x: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

**Table y: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

Where the variable M, P, N are the same as Section 9.5.4.2 for L1-RSRP reporting. * + Option 1a (MTK): similar to above Option 1, but define P as determined by the ratio of available L1-SINR measurement occasions over all occasions.
		- A L1-SINR measurement occasion is considered as available only when the CMR and the associated IMR are non-overlapped with measurement gap or SMTC window.
	+ Option 1b (Samsung): same as above Option 1, but adding assumption to make CSI-IM not overlapped with MG or SMTC.
	+ Option 1c (Qualcomm, Samsung): same as above Option 1, but FFS the value of P.
	+ Option 2 (Ericsson, Nokia): similar to above option 1, but replace TCSI-RS by max(TCSI-RS, TIMR).

*[Moderator] Similar situation as Issue 1-1-4.* *Tentative agreements: N/A.* *Recommendations for 2nd round: Similar decision should be taken as Issue 1-1-4.*  |
| *Issue 1-1-6: Side condition for measurement accuracy:** Option 1 (Samsung, Qualcomm, Ericsson): Following previous meeting’s simulation assumption, i.e., -3dB for ideal SINR
	+ For NZP-IMR: Side condition (SNR) on CMR and Side condition (INR) on IMR are both 0dB
	+ For ZP-IMR: Side condition (SNR) on CMR are -3dB.
* Option 2 (MTK, Huawei): the side condition on CMR across cases should be the same.
	+ For NZP-IMR: Side condition (SNR) on CMR and Side condition (INR) on IMR are both -3dB, target SINR is -4.77dB
	+ For ZP-IMR: Side condition (SNR) on CMR are -3dB.

*[Moderator] Explanation/revision on option is provided as highlighted text, such that option 1 is just following previous RAN4 agreed assumption for L1-SINR evaluation. Further clarification gives to both options per requested by Intel, also highlighted. No clear majority view observed. However, Moderator suggest we should follow previous agreement for evaluation, otherwise, more meeting cycles will be needed to align with measurement accuracy. Besides that, the issue for different CMR SNR as mentioned by MTK is already elaborated and considered in last meeting (otherwise the WF from last meeting shall not be approved).* *Tentative agreements: Suggest to agree Option 1 by aligning previous meeting’s agreement.* *Recommendations for 2nd round: If above tentative agreement is not achieved in 1st round, continue discussion.*  |
| *Issue 1-1-7: Number of Samples for L1-SINR Measurement:** Option 1 (MTK, Samsung, Ericsson, Huawei, Nokia): ~~Common accuracy requirement~~ M = [3] if single shot measurement is not applicable for CMR-only, SSB+NZP-IMR, SSB+ZP-IMR, CSI-RS+NZP-IMR and CSI-RS+ZP-IMR.

*[Moderator] For clarification to Companies’ question and comment, the above discussion is only focusing on core requirement (performance part is not started yet based on TU allocation) at least from our perspective, so there is no implication for measurement accuracy. Rephrase option 1 for clarification. Measurement accuracy can be initially checked based on companies’ input, while M = [3] can be kept until accuracy evaluation is done.* *Tentative agreements: Suggest to agree Option 1 with above clarification and revision.* *Recommendations for 2nd round: If above tentative agreement is not achieved in 1st round, continue discussion.* |
| *Issue 1-1-8: Number of Scaling for FR2 (value of N)** Option 1 (MTK, Samsung, Qualcomm, Intel): the measurement period is scaled with N defined as same as L1-RSRP.
* Option 2 (Huawei): For the cases of CMR only, SSB+IMR, CSI-RS+ZP-IMR, we can agree on option 1. The variable N can be defined as same as L1-RSRP. For the case of CSI-RS+NZP-IMR, The variable N needs to be FFS.

*Tentative agreements: N/A**Recommendations for 2nd round: Continue discussion on both options.* |
| **Sub-topic 1-2** | *Issue 1-2-1: NZP-IMR: QCL indication** Option 1 (Samsung, Qualcomm, Intel, Huawei): For L1-SINR reporting with CMR + NZP-IMR configured in one CSI report, L1-SINR measurement requirements apply only if the NZP-IMR is not configured in another CSI report whose CMR is not Type-D QCLed; otherwise, longer measurement requirement is expected.
* Option 2 (MTK): agree on some high-level principles first, e.g.
	+ CMRs in 2 reports should be Type-D QCLed, if the same NZP IMR is configured.
	+ CMR and IMR should be Type-D QCLed in one report. (as RAN1 agreement)
		- It addresses the case that NZP CSI-RS is configured as CMR in one report and configured as IMR in other report, since all the CMR/IMR in two reports are QCLed.

*[Moderator] Pre requested, we can clarify on option 1, i.e., NZP-IMR in 1st CSI report can be configured as either CMR in 2nd CSI report or NZP-IMR in 2nd CSI report. In both situations, CMRs in 1st and 2nd CSI reports shall be QCL-ed, otherwise long measurement requirement is expect. Therefore, Option 1 contains the 1st sub-bullet in Option 2. Furthermore, we prefer to discuss on Option 1 directly (with above clarification), otherwise we don’t see the value of repeating RAN1 agreement as RAN4 agreement.* *Tentative agreements: Suggest to agree Option 1 (based on above clarification and majority view).**Recommendations for 2nd round: If above tentative agreement is not achieved in 1st round, continue discussion.* |
| *Issue 1-2-2: NZP-IMR: “repetition = on”** For CSI-RS configured as NZP-IMR in FR2, whether “repetition = on” is configurable:
	+ Option-1: NZP-IMR can be configured with “repetition = off” or “repetition = on”:
		- Not to define requirement for L1-SINR estimation if NZP-IM is configured as “repetition=ON”.
	+ Option-2 (Samsung): NZP-IMR can be configured with “repetition = off” or “repetition = on” if the CSI-RS resource set is used for the other purpose than this L1-SINR measurement report:
		- RX beam for NZP-IMR shall follow CMR, i.e., same RX filter shall be used.
	+ Option-3 (Qualcomm): NZP-IMR can be configured with “repetition = off” or “repetition = on”:
		- CMR and NZP-IMR should be configured with the same repetition pattern.
		- CMR and NZP-IMR should not overlap in time domain if they are configured with “repetition = on”.
	+ Option-4 (MTK, Intel, Huawei): Depending on scenarios (i.e., configuration restriction):
		- SSB based CMR and NZP-IMR with “repetition = ON” is error configuration;
		- SSB based CMR and NZP-IMR with “repetition = OFF” is correct configuration;
		- NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = ON” is correct configuration;
		- NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = OFF” is correct configuration;
		- NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = ON” is error configuration;
		- NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = OFF” is correct configuration.

*Tentative agreements: N/A**Recommendations for 2nd round: Continue discussion on options.* |
| *Issue 1-2-3: ZP-IMR: “repetition = on”** For CSI-RS configured as ZP-IMR in FR2, whether “repetition = on” is configurable:
	+ Option 1 (MTK, Samsung, Intel, Huawei): “Repetition” field should not be present for ZP-IMR’s CSI-RS resource set configuration.
	+ Option 2: ZP-IMR CSI-RS can be configured with “repetition = off” in FR2.
	+ Option 3 (Qualcomm): ZP-IMR CSI-RS shall only be configured with “repetition = off” in FR2.

*[Moderator] No big difference between Option 1 and Option 3, but depending on RAN1 and detailed RAN2 signaling design.* *Tentative agreements:* *Recommendations for 2nd round: Double check other working group’s agreement.*  |
| *Issue 1-2-4: Measurement restriction between L1-SINR and L1-RSRP** Option 1 (MTK, Samsung, Huawei): For CMR+IMR scenario, RAN4 study when the measurement restrictions need to be applied between L1-SINR measurement and L1-RSRP measurements.
* Option 2 (Ericsson): gNB can configure channel measurement restriction and interference measurement restriction for L1-SINR and L1-RSRP independently

*[Moderator] Seems Option 1 and 2 are not totally contradicting, instead Option 1 is open for FFS on this issue, and we assume Option 1 should be agreeable to the group.* *Tentative agreements: Suggest Option 1 as agreement**Recommendations for 2nd round: FFS on this issue.*  |
| **Sub-topic 1-3** | *Issue 1-3-1: L1-SINR measurement side condition for Es/Iot for CMR+ZP-IMR* * Proposals for Es/Iot on CMR (MTK, Samsung, Qualcomm, Huawei):
	+ Option 1: SSB or CSI-RS Es/Iot >= -3dB and <=25dB

*Tentative agreements: Suggest to agree Option 1 based on consensus.* *Recommendations for 2nd round: N/A.* |
| *Issue 1-3-2: L1-SINR measurement side condition for Es/Iot for CMR+NZP-IMR** Proposals for Es/Iot on CMR and NZP-IMR:
	+ Option 1 (MTK, Samsung, Huawei): Es/Iot >= -3dB and <=25dB
	+ Option 2 (Qualcomm, Ericsson): Es/Iot >=0dB and <=25dB, and the resultant L1-SINR should also lie between -3 dB and 25 dB.

*[Moderator] Related to issue 1-1-5.* *Tentative agreements: N/A**Recommendations for 2nd round: Continue discussion on both options.* |
| *Issue 1-3-3: Clarification on ZP-IMR configuration** Proposals for ZP-IMR configuration:
	+ Option 1: ZP CSI-RS (as agreed in the simulation assumption in the last meeting)
	+ Option 2 (MTK, Samsung, Nokia): CSI-IM (to align with RAN1 specification)

*[Moderator] Qualcomm propose to postpone the discussion at least to 2nd round, so we suggest to decide the majority view (Option 2) can be followed or not. It is also Moderator’s understanding that approving Option-2 to align with RAN1 will not have impact on measurement accuracy evaluation result, but only impact on CR drafting. If company have different understanding, comments are appreciated.* *Tentative agreements: N/A**Recommendations for 2nd round: Decide the majority view (Option 2) can be followed or not* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | Way forward on NR eMIMO RRM (Prefer a single WF to cover all three topics, as previous meeting’s way of working) | Samsung |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2000997 | Moderator suggest Chair to endorse the editorial change in this draft CR, which can be combined with R4-1915607 which has been endorsed in Reno meeting.  |
| R4-2000288 | Continue to receive detailed comments from companies except the open issues listed above.  |

## Discussion on 2nd round (if applicable)

*The 2nd round discussion is under the topic of WF drafting, while the discussion history is captured here for information.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sub-topic 1-1: L1-SINR measurement period* **Restriction between measurement time restriction on IMR and CMR**
	+ In a single CSI-reportConfig with L1-SINR CMR+IMR measurement, the same measurement time restriction should be applied for CMR and IMR, i.e., both RRC signalling IE timeRestrictionForChannelMeasurements and timeRestrictionForInterferenceMeasurements should be configured or notConfigured
	+ [Moderator] Ericsson is asked to check the possibility to compromise to above agreement based on majority view.
	+ [Ericsson] If the condition is when NW configures both timeRestrictionForChannelMeasurements and timeRestrictionForInterferenceMeasurements, we are ok to apply the same measurement time restriction for CMR and IMR. In our understanding, this issue is talking about the case highlighted in yellow in the table below.

|  |  |  |
| --- | --- | --- |
|  |  | CMR measurement restriction(timeRestrictionForChannelMeasurement) |
|  |  | Not configured | Configured |
| IMR measurement restriction(timeRestrictionForInterferenceMeasurements) | Not configured | MCMR=3, MIMR=3 | MCMR=1, MIMR=1 |
| Configured | MCMR=1, MIMR=1 | MCMR=1, MIMR=1 |

* + [Moderator2] Actually, our original intention is restrict NW configuration, rather than make sure the applicable UE behavior, which should be decided by next topic. Considering that, we are okay to remove the discussion for “restriction btw measurement time restriction on IMR and CMR”, but just focusing on next topic to make progress.
* **Applicable condition(s) for one-shot L1-SINR measurement report for CMR+IMR scenario:**
	+ M=1 shall be applied if
		- aperiodic CSI-RS resource is configured for interference measurement (for SSB-based CMR or aperiodic CSI-RS based CMR), or
		- periodic or semi-persistent CSI-RS resource is configured for channel and/or interference measurement and higher layer parameter timeRestrictionForChannelMeasurements or timeRestrictionForInterferenceMeasurements is configured.
	+ [Moderator] Ericsson is asked to check the possibility to compromise to above agreement based on majority view.
	+ [Ericsson] We are ok to set M=1 when higher layer parameter when timeRestrictionForChannelMeasurements **or** timeRestrictionForInterferenceMeasurements is configured. On the other hand, we don’t understand the note ‘timeRestrictionForChannelMeasurements **and** timeRestrictionForInterferenceMeasurements shall both be configured’. It looks this note is not aligned with previous sentence. We would like to clarify the cases highlighted in pink in the table above. We would like to hear the opinion on those cases. For the progress, we propose to agree with the case highlighted in yellow, but FFS for cases highlighted in pink.
	+ [Moderator2] I suggest to remove the Note. So the description is exactly the same as your table. Hope it is okay to you. As we comment in previous point, it is okay for us to leave the requirement applicability rule as your table but left NW configuration possibility open.
* **Measurement period for SSB-based CMR+IMR scenario:**
	+ By following L1-RSRP measurement requirement and restricting CMR and IMR’s 1-to-1 mapping, measurement period requirements for FR1 and FR2 shall be defined as:

**Table x: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity~~, and it shall be in the CSI-RS resource set with “repletion=OFF”~~  |

**Table y: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity~~, and it shall be in the CSI-RS resource set with “repletion=OFF”.~~  |

* + - FFS how to define the value of P, and whether or not a single P value for both CMR and IMR.
		- FFS the scaling factor N under different conditions of “repetition” field of IMR.
	+ [Moderator] We combine companies’ proposed Option 1/1a/1b/1c, and left FFS for P. Ericsson and Nokia is asked to check the possibility to compromise to above agreement based on majority view, especially considering Option 2 is contradicting to approved WF [R4-1915850].
	+ [MTK] On note 2, it should clarify the CSI-RS resource is in the CSI-RS resource set with “repletion=OFF”. Because different SSB are implying different Tx beam from NW, hence the 1-to-1 mapping rule will be violated if NZP-IMR is configured as “repletion=ON”.
	+ [Intel] If P is FFS, it seems that the P is the same for both CMR and IMR. Can network guarantee that the confliction of CMR and IMR with SMTC/MG are the same?
	+ [Ericsson] We are ok to assume the same transmission periods of both CMR and IMR. However since we should not exclude the case NW configures different transmission period of CMR and IMR, we propose to revise the note 2 as follow:. ”The requirements are applicable provided that the CSI-RS resource configured for interference measurement is 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.”
	+ [Moderator2] I try to solve everyone’s concern in the revised tentative agreement:
		- To MTK: The intention of this tentative agreement is to make sure the requirement structure agreeable to the group, while for the detailed condition of “repetition = OFF/ON”, we have another topic to discuss. If we add your sentence here, it could be another discussion for the expected performance if this condition is not satisfied. I suggest have another bullet to solve your concern, and I think in the end, the issue of “repetition =ON/OFF” should be captured in N value’s condition…..
		- To Intel, I think the revision on the bullet of P can solve your concern.
		- To Ericsson, your comments are okay to us, and captured.
	+ [Nokia] OK with the proposed modifications.
* **Measurement period for CSI-RS-based CMR+IMR scenario:**
	+ By following L1-RSRP measurement requirement and restricting CMR and IMR’s 1-to-1 mapping, measurement period requirements for FR1 and FR2 shall be defined as:

**Table x: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

**Table y: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms)**  |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.Note 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.  |

* + - FFS how to define the value of P, and whether or not a single P value for both CMR and IMR.
		- FFS the scaling factor N under different conditions of “repetition” field of CMR and IMR.
	+ [Moderator] Similar approach as the above SSB-based CMR+IMR scenario.
	+ [MTK] It should be noted that this measurement period only applies on the valid configurations of NZP-IMR/ZP-IMR, regarding the “repetition”, depending on the discussion of issue “NZP-IMR: “repetition = on”.
	+ [Ericsson] Same comments as SSB-based CMR+IMR scenario. We propose to revise note 2 as follows:  The requirements are applicable provided that the CSI-RS resource configured for interference measurement is 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.
	+ [Moderator2] Changed accordingly:
		- To Ericsson: same change;
		- To MTK: same bullet is added for repetition field. Yes, requirements are applicable if configuration are valid, as all other requirements did. Whether and when some configuration is regarded as “invalid”, I assume companies are still not aligned as below discussion. Because of having that discussion, I initially don’t believe we have to repeat this thing in everywhere, but anyway.
		- To Intel: same bullet added for the value of P, although you don’t comment here….
	+ [Nokia] the same comment as SSB-based CMR+IMR scenario
* **Side condition for measurement accuracy:**
	+ Following previous meeting’s simulation assumption, i.e., -3dB for ideal SINR
		- For NZP-IMR: Side condition (SNR) on CMR and Side condition (INR) on IMR are both 0dB
		- For ZP-IMR: Side condition (SNR) on CMR are -3dB.
	+ [Moderator] MTK and Huawei is asked to check the above side condition, which follows previous meeting’s simulation assumption.
	+ [MTK] we can comprise to the suggested agreement.
	+ [Intel] please clarify for the side condition of CMR where SNR=0dB. Did interference transmitted on CMR and interference power is identical to that on the IMR? Or only useful signal and noise are transmitted on CMR?
	+ [Huawei] we can comprise to the suggested agreements. However, we still want to point out that the L1-SINR measurement error includes two inputs, signal measurement error on CMR and interference measurement error on IMR. The interference measurement error on IMR is very small. So, the L1-SINR measurement error mainly depends on the signal measurement error on CMR. Obviously, the signal measurement with CMR SNR=0dB will show a better accuracy that with CMR SNR=-3dB.
	+ [Moderator2] To MTK and Huawei, thanks for your compromise. To Huawei, I have the same understanding as you for the expected performance. To Intel, only useful signal are transmitted on CMR, so just useful signal and noise on CMR REs.
* **Number of Samples for L1-SINR Measurement:**
	+ M = [3] if single shot measurement is not applicable for CMR-only, SSB+NZP-IMR, SSB+ZP-IMR, CSI-RS+NZP-IMR and CSI-RS+ZP-IMR.
	+ [Moderator] The confusing wording “common accuracy requirement” is removed, and I assume the above bullet should be agreeable based on the 1st round feedback.
* **Number of Scaling for FR2 (value of N)**
	+ For the cases of CMR only,
		- the variable N can be defined as same as L1-RSRP.
	+ For the case of CSI-RS+NZP-IMR, SSB+IMR, CSI-RS+ZP-IMR
		- FFS the variable N.
	+ [Moderator] Since some companies are questioning N value for CSI-RS+NZP-IMR, Moderator suggest the above tentative agreement to FFS N value for CSI-RS+NZP-IMR scenario.
	+ [MTK] It needs more discussion, even for the case of SSB+IMR, CSI-RS+ZP-IMR,. E.g. for SSB+IMR, should the N follow SSB L1-RSRP, i.e. N=8, or it should follow CSI-RS L1-RSRP’s N factor? CMR only case is ok.
	+ [Moderator2] To MTK, although our original tentative agreement follows your 1st round comment but just consider Huawei’s comment on CSI-RS+NZP-IMR case, anyway we are okay with your 2nd round comment. Btw, from Samsung’s understanding, we don’t see any reason why SSB+IMR should not follow N=8 and CSI-RS+ZP-IMR should not follow L1-CSI-RSRP requirement.

Sub-topic 1-2: Measurement Restriction and Scheduling Availability* **NZP-IMR: QCL indication**
	+ For L1-SINR reporting with CMR + NZP-IMR configured in one CSI report, L1-SINR measurement requirements apply only if the NZP-IMR is not configured in another CSI report whose CMR is not Type-D QCLed; otherwise, longer measurement requirement is expected.
	+ [Moderator] Above tentative agreement is based on majority view.
	+ [Moderator] Pre requested, we can clarify on option 1, i.e., NZP-IMR in 1st CSI report can be configured as either CMR in 2nd CSI report or NZP-IMR in 2nd CSI report. In both situations, CMRs in 1st and 2nd CSI reports shall be QCL-ed, otherwise long measurement requirement is expect. Therefore, Option 1 contains the 1st sub-bullet in Option 2. With this clarification, MTK is asked to check the possibility to compromise the above tentative agreement based on majority view.
	+ [MTK] To confirm our understanding that if the CMRs in 2 CSI reports are SSBs, then it implies they are the same SSB (with the same SSB index)? If that is the correct understanding, the suggested agreement is fine for us.
	+ [Moderator2] To MTK, yes your understanding is correct.
* **NZP-IMR: “repetition = on”:**
	+ For CSI-RS configured as NZP-IMR in FR2, whether “repetition = on” is configurable:
		- Option-1: NZP-IMR can be configured with “repetition = off” or “repetition = on”:
			* The configuration of “repetition = on/off” is present only if its CSI-RS resource set is used for the other purpose than this L1-SINR measurement report;
			* RX beam for NZP-IMR for L1-SINR measurement shall always follow CMR, i.e., same RX filter shall be used.
		- Option-2: NZP-IMR can be configured with “repetition = off” or “repetition = on”:
			* CMR and NZP-IMR should be configured with the same repetition pattern.
			* CMR and NZP-IMR should not overlap in time domain if they are configured with “repetition = on”.
		- Option-3: Depending on scenarios (i.e., configuration restriction):
			* SSB based CMR and NZP-IMR with “repetition = ON” is error configuration;
			* SSB based CMR and NZP-IMR with “repetition = OFF” is correct configuration;
			* NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = ON” is correct configuration;
			* NZP CSI-RS based CMR with “repetition = ON” and NZP-IMR with “repetition = OFF” is correct configuration;
			* NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = ON” is error configuration;
			* NZP CSI-RS based CMR with “repetition = OFF” and NZP-IMR with “repetition = OFF” is correct configuration.
	+ [Moderator] Consider the different views remains, we suggest to keep all suggested options open for further discussion in next meeting.
* **ZP-IMR: “repetition = on”:**
	+ For CSI-RS configured as ZP-IMR in FR2, whether “repetition = on” is configurable:
		- Option-1: “Repetition” field should not be present for ZP-IMR’s CSI-RS resource set configuration.
		- Option-2: ZP-IMR CSI-RS shall only be configured with “repetition = off” in FR2.
	+ [Moderator] No big difference between Option 1 and Option 3, but depending on RAN1 and detailed RAN2 signaling design. Therefore we suggest to keep both options open for further discussion in next meeting.
* **Measurement restriction between L1-SINR and L1-RSRP**
	+ For CMR+IMR scenario, FFS when the measurement restrictions need to be applied between L1-SINR measurement and L1-RSRP measurements.
	+ [Moderator] FFS this issue.
	+ [MTK] We support to FFS this issue.
	+ [Ericsson] We support it to FFS in this meeting.
	+ [Moderator2] Thanks and I think we are aligned on this.

Sub-topic 1-3: Side condition and Others* **L1-SINR measurement side condition for Es/Iot for CMR+NZP-IMR**
	+ Es/Iot on CMR and NZP-IMR:
		- Option-1: Es/Iot >= -3dB and <=25dB
		- Option-2: Es/Iot >=0dB and <=25dB, and the resultant L1-SINR should also lie between -3 dB and 25 dB.
	+ [Moderator] FFS this issue by keeping both options open.
 |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| R4-2002242 | Based on 2nd round email discussion, moderator recommend that WF should be *approved*. |
| R4-2000288 | Based on comments collected, moderator recommend that CR should be *postponed*.  |
| R4-2000287 | This is the Tdoc placeholder for result summary and considering measurement accuracy will be defined in performance part, moderator recommend companies to further provide results or result updates if any, and the summary can be given in next meeting. So moderator recommend this result summary can be *withdrawn* in this meeting.  |

# Topic #2: SCell Beam Failure Recovery

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000289 | Samsung | Proposal-1: In RAN4 RRM requirement, UE is not required to perform link recovery (BFD and CBD) on a deactivated SCell. Proposal-2: UE is not required to perform BFD and CBD on SCell within active BWP of the configured CC.Proposal-3: For SCell BFD, only CSI-RS based BFD (periodic 1-port CSI-RS) is applicable. Proposal-4: For SCell BFD, Rel-15 CSI-RS based BFD requirement shall be followed, and detailed requirement captured in Section 8.5.3 shall be reused for SCell BFD. Proposal-5: For SCell CBD, Rel-15 SSB-based and CSI-RS based BFD requirement shall be followed, and detailed requirement captured in Section 8.5.5 and 8.5.6 shall be reused for SCell BFD. Observation-1: In Rel-16 eMIMO WI, RAN1 introduced new mechanism of beam failure recovery request (BFRQ), with two steps relying on SR-like PUCCH and MAC CE on SpCell:Step 1 is carried by a dedicatedly configured SR-like PUCCH in PCell or PSCell to inform gNB beam failure happensStep 2 is carried by a MAC CE to report detail information, e.g. failed CC index and new beam index* If at least one new beam is identified (L1-RSRP is higher or equal to the threshold)
	+ UE reports 1 new beam index and failed CC index
* Else
	+ UE reports no new beam identified and failed CC index

Observation-2: In SCell BFRQ, the procedure of informing gNB beam failure happens and reporting detailed information (failed CC and new beam index (or no beam identified)), has no big impact on existing core requirement of BFD and CBD.Proposal-6: For SCell BFRQ mechanism introduced in Rel-16, RAN4 still define RRM requirement by following Rel-15 specification architecture for BFD and CBD. The new procedure of informing gNB beam failure happens and reporting detailed information will not have core requirement impact on TS38.133. Proposal-7: The maximum number of SCell for which UE performs BFR is a UE capability.  |
| R4-2000290 | Samsung | CR to TS38.133 on SCell BFD and CBD (Section 8.5) |
| R4-2000291 | Samsung | CR to TS38.133 on SCell BFRQ Procedure (Section 8.5) |
| R4-2000938 | MediaTek inc. | Observation 1: It is sufficient to perform BFD procedure on one serving cell on the same FR2 band, since UE assumes the same downlink spatial domain transmission filter for the serving cells on the same FR2 band. Proposal 1: In FR2, UE is assumed to measure BFD-RS transmitted on only one serving cell per FR2 band.Proposal 2: For one FR2 band, only one serving cell is transmitting BFD-RS(s), which can be implicitly configured to other serving cells on the same FR2 band for BFD procedure.Proposal 3: If SpCell is on a FR2 band, BFD-RS should be transmitted on the SpCell. For the FR2 band without SpCell, BFD-RS should be transmitted on only one of SCells in that band.Proposal 4: For one FR2 band, the evaluation periods for SSB/CSI-RS based BFD and CBD on SCell can reuse R15 BFD and CBD requirements, provided UE is assumed to measure BFD-RS transmitted on only one serving cell per FR2 band. FFS SCell BFR for multiple FR2 bands. Proposal 5: No core requirement impact for R16 BFRQ. Proposal 6: UE is not required to monitor BFD-RS transmitted on a deactivated SCell, as the BFD-RS is implicitly configured for another activated cell. Proposal 7: UE is not required to monitor BFD-RS explicitly or implicitly configured for a deactivated SCell, even though the BFD-RS is transmitted on an activated cell.  |
| R4-2001580 | Huawei, HiSilicon | Proposal 1: It is suggested that UE is not required to perform BFD on RS within an activated SCC which is implicitly configured as the BFD-RS for another deactivated SCell.Proposal 2: It is suggested that UE is not required to perform BFD on RS within a deactivated SCC which is implicitly configured as the BFD-RS for another activated SCell.Proposal 3: When more than 2 BFD-RSs are transmitted on a CC for current serving cell and other SCell, the UE is allowed only to perform beam failure detection on the BFD-RSs for current serving cell.Proposal 4: It is suggested not to introduce a new sharing factor for BFD and CBD evaluation period requirements.Observation 1: There is no RRM core requirement impact by SCell BFRQ procedure.Proposal 5: Step-1 and Step-2 of SCell BFRQ procedure which shall be defined in RAN1 specification can be verified in SCell link recovery test.Observation 2: A SCell with CBD-RS configuration can be considered as a SCell configured for BFR.Proposal 6: It is suggested that UE is not required to perform BFD and CBD for a SCell which is not configured with CBD-RS resources.Proposal 7: It is left to UE implementation on how to down-select the activated SCell for BFR when the configured activated SCell for BFR exceeds the maximum number of SCell BFR by UE capability signalling. |
| R4-2002121 | Qualcomm | Observation 1: If proposal 4 gets agreed, then UE only needs to perform BFD/CBD for up to one SCell in FR2.Proposal 1: UE is not required to perform BFD on RS within a deactivated SCC which is implicitly configured as the BFD-RS for another activated SCellProposal 2: UE is not required to perform BFD on RS within an activated SCC which is implicitly configured as the BFD-RS for another deactivated SCell.Proposal 3: When more than 2 BFD-RSs are transmitted on a CC for current SCell and implicity configured for SCell, UE is required to only perform BFD on BFD-RSs for current SCell.Proposal 4: For BFD and CBD requirements in FR2, only one serving cell is assumed to perform BFR procedure for one FR2 bandProposal 5: RAN4 supports introducing a sharing factor in the BFD and CBD evaluation period for SCells in FR1.* The sharing factor is proportional to the number of SCells for which UE is performing BFD/CBD.
* Note: This proposal assumes that UE is performing BFR for only one serving cell in each FR2 band.

Proposal 6: RAN4 defines requirement for step 1 of BFR, where UE reports beam failure event through a dedicated SR like PUCCH resources, in SCells with DL only.* No RRM core requirement is defined for UE conveying new beam information and failed CC indices via MAC-CE.

Proposal 7: After detecting beam failure in an Scell and determining that the L1-RSRP of one candidate beam in SCell is greater than the configured threshold, UE is required to transmit scheduling request in the PSCell within a period T* Where T is equal to the periodicity of PUCCH that has been configured with schedulingRequestForBFR.
 |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1: BFD on SCell

**Issue 2-1-1: Necessity of BFD procedure on multiple serving cell on the same FR2 band**

* Proposals:
	+ Option-1: For BFD and CBD requirements in FR2, only one serving cell is assumed to perform BFR procedure for one FR2 band.
	+ Option-1a: In FR2, UE is assumed to measure BFD-RS transmitted on only one serving cell per FR2 band, which can be implicitly configured to other serving cells on the same FR2 band for BFD procedure:
		- For SpCell is on a FR2 band, BFD-RS should be transmitted on the SpCell.
		- For the FR2 band without SpCell, BFD-RS should be transmitted on only one of SCells in that band
	+ Option-2: No restriction introduced in RAN4.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 2-1-2: Sharing factor for BFD Time Period for FR2**

* [Moderator]: In last meeting, since Rel-16 BFR could be performed over multiple SCells (based on UE capability), some company propose that it would require to investigate whether or not to introduce sharing factor when multiple SCells are configured for BFR procedure, i.e., for BFD and CBD time periods..
* Proposals:
	+ Option-1: No BFD evaluation period will be specified if BFR is configured over multiple FR2 intra-band cells:
		- Sharing factor for BFD evaluation period due to BFD over multiple FR2 intra-band cells will not be introduced.
		- FFS SCell BFD for FR2 inter-band FR2 CA.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 2-1-3: Sharing factor for BFD Time Period for FR1**

* [Moderator]: In last meeting, since Rel-16 BFR could be performed over multiple SCells (based on UE capability), some company propose that it would require to investigate whether or not to introduce sharing factor when multiple SCells are configured for BFR procedure, i.e., for BFD and CBD time periods..
* Proposals:
	+ Option-1: RAN4 supports introducing a sharing factor in the BFD and CBD evaluation period for SCells in FR1.
		- The sharing factor is proportional to the number of SCells for which UE is performing BFD/CBD.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 2-1-4: RS within a deactivated SCC is implicitly configured as the BFD-RS for another activated SCell**

* Proposals:
	+ Option 1: UE is not required to perform BFD on RS within a deactivated SCC which is implicitly configured as the BFD-RS for another activated SCell
* Recommended WF
	+ Suggest RAN4 agree on Option 1.

**Issue 2-1-5: RS within an activated SCC is implicitly configured as the BFD-RS for another deactivated SCell**

* Proposals:
	+ Option 1: UE is not required to perform BFD on RS within an activated SCC which is implicitly configured as the BFD-RS for another deactivated SCell.
* Recommended WF
	+ Suggest RAN4 agree on Option 1.

**Issue 2-1-6: When more than 2 BFD-RSs are transmitted on a CC for current SCell and (implicitly configured for) other SCell**

* Proposals: When more than 2 BFD-RSs are transmitted on a CC for current SCell and (implicitly configured for) other SCell
	+ Option 1: UE is allowed only to perform beam failure detection on the BFD-RSs for current serving cell.
	+ Option 2: it is up to UE implementation to select two BFD-RSs in active BWP in current CC to perform BFD (either for current SCell or for other Sell(s)).
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 2-1-7: RAN1 specification and RAN4 agreement mismatch for SSB-based BFD on SCell**

* [Moderator]: In last RAN4 meeting, it is agreed that “CSI-RS and SSB based BFD for SCell BFD can be applied”, based on the argument that SSB based BFD for PCell/PSCell is also introduced in RAN4 while not explicitly defined in RAN1 spec. However, based on the agree specification and RAN1 agreement, SSB-based BFD for SCell is explicitly not included. Based on the above RAN1 agreement and approved CR to TS38.213, it is clear RAN1 understanding that SCell BFD should only be performed based on periodic CSI-RS, for both explicit configuration (a set  of periodic CSI-RS resource configuration indexes by beamFailureDetectionResourceList) and implicit configuration (the UE determines the set to include periodic CSI-RS resource configuration indexes with same values as the RS indexes in the RS sets indicated by TCI-State for respective CORESETs that the UE uses for monitoring PDCCH) .
* Proposals:
	+ Option-1: Revert RAN4 agreement by only allowing SSB based BFD for SCell;
	+ Option-2: Allowing SSB based BFD for SCell but no RAN4 requirement (core and test cases) to be defined.
	+ Option-3: Define RAN4 requirements for SSB based BFD for SCell, but let RAN1 be notified about RAN4 agreement.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

### Sub-topic 2-2: CBD on SCell

**Issue 2-2-1: Sharing factor for CBD Time Period**

* Proposals:
	+ Option-1: No CBD evaluation period will be specified if BFR is configured over multiple FR2 intra-band cells:
		- Sharing factor for CBD evaluation period (due to CBD over multiple FR2 intra-band cells) will not be introduced.
		- FFS SCell BFD for FR2 inter-band FR2 CA.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

### Sub-topic 2-3: Beam Failure Recovery Request (BFRQ)

**Issue 2-3-1: RAN4 requirement defined for two step BFRQ mechanism**

* Proposals:
	+ Option-1: For SCells with DL only and SCells with DL and UL, RAN4 requirement is defined for two step BFRQ mechanism,
		- Step-1: UE reports beam failure event through a dedicated SR like PUCCH resource;
		- Step-2: UE conveys new beam information (if identified) and failed CC index(es) via MAC-CE.
	+ Option-2: RAN4 defines requirement for step 1 of BFR, where UE reports beam failure event through a dedicated SR like PUCCH resources, in SCells with DL only.
		- No RRM core requirement is defined for UE conveying new beam information and failed CC indices via MAC-CE.
	+ Option-3: No core requirement impact for Rel-16 BFRQ.
	+ Option-3a: No core requirement impact for Rel-16 BFRQ, and Step-1 and Step-2 of SCell BFRQ procedure which shall be defined in RAN1 specification can be verified in SCell link recovery test.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 2-3-2: BFRQ requirement details (if core requirement is agreed to be introduced)**

* Proposals:
	+ Option-1: After detecting beam failure in an Scell and determining that the L1-RSRP of one candidate beam in SCell is greater than the configured threshold, UE is required to transmit scheduling request in the PSCell within a period T
		- Where T is equal to the periodicity of PUCCH that has been configured with schedulingRequestForBFR.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

### Sub-topic 2-4: UE Capability and Applicability

**Issue 2-4-1: UE Capability of Number of SCells for BFR**

* Proposals:
	+ Option-1: RAN4 requirement should not block the possibility of configuring BFR on multiple SCells, and no RAN4 performance requirement will be defined for more than 1 serving cell perform BFR procedure.
	+ Option-2: It is left to UE implementation on how to down-select the activated SCell for BFR when the configured activated SCell for BFR exceeds the maximum number of SCell BFR by UE capability signalling.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 2-4-2: CBD-RS not configured**

* Proposals:
	+ Option-1: UE is not required to perform BFD and CBD for a SCell which is not configured with CBD-RS resources.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | Sub topic 2-1: Issue 2-1-1:We agree option 1 and option-1a. Based on UE assumes the same downlink spatial domain transmission filter for the serving cells on the same FR2 band, it is sufficient only one serving cell performing BFR in a FR2 band. Issue 2-1-2:We propose option 1 sharing factor for BFD evaluation period does not need to introduce for FR2 intra-band CCs. For FR2 inter-band CCs, the sharing factor can be proportional to the number of inter-band FR2 CA.Issue 2-1-3:For FR1, we agreeoption-1 that the sharing factor is proportional to the number of SCells for which UE is performing BFD/CBD.Issue 2-1-4:We suggest option 1 that UE is not required to perform BFR procedure proposed on deactivated SCell for actived SCell in order to save power. Besides, network can avoid this case by configuring another SCell to transmit BFD-RS.Issue 2-1-5:We suggest option 1 that UE is not required to perform BFR procedure on activated SCell for deactivated Cell due to the deactivated SCell has no data transmission requirement.Issue 2-1-6: For FR2, the use case to configure more than 2 BFD-RS is unclear, since cells are co-located and the same 2 BFD-RS can be configured for all cells. It seems this discussion is only valid in FR1.We are also fine with option 2.Issue 2-1-7:We suggest option 3. The 38.213 is consistence, in section 6, where SSB based BFD is still mentioned. “For the **set** $\overbar{q}\_{0}$, the UE assesses the radio link quality only according to periodic CSI-RS resource configurations or **SS/PBCH blocks** that are quasi co-located, as described in [6, TS 38.214], with the DM-RS of PDCCH receptions monitored by the UE.” We could notify RAN1 for the clarification, and the requirement can be still discussed in RAN4, as the same handling in R15. (Option 3). Option 1 is also fine for us, after checked with RAN1 colleagues.Sub topic 2-2:Issue 2-2-1: We propose option 1 sharing factor for CBD evaluation period does not need to introduce for FR2 intra-band CCs. For FR2 inter-band CCs, the sharing factor can be proportional to the number of inter-band FR2 CA.Sub topic 2-3:Issue 2-3-1:We suggest option-3, no core requirement impact for Rel-16 BFRQ. In R15, the PRACH procedure triggered by BFR is consider as the end point of delay requirement. Similarly, the PUCCH-BFR triggered by BFR can also be considered as the end point of delay requirement. Therefore, the core requirement will not be impacted by the new procedure of informing gNB beam failure and reporting detailed information. Issue 2-3-2:It should be further discussed. One observation is, in the step 1, PUCCH-BFR procedure could be skipped if UE has MAC CE resource, MAC-CE can be transmitted via PUSCH, without involvement with PUCCH-BFR..Besides, more discussion on proposal option 1 is needed. The starting time of T (after detecting beam failure in an Scell and determining candidate beam in SCell) would be unknown at network, since network has would not the exact timing that the candidate beam has been determined by UE. Hence, how to capture T in specification should be FFS.Sub topic 2-4:Issue 2-4-1:We agree option-1. RAN4 requirement should not block the possibility of configuring BFR on multiple SCells, and no RAN4 performance requirement will be defined for more than 1 serving cell perform BFR procedure.Issue 2-4-2: We agree option-1.Following RAN1 98bis agreement, UE assume that CBD is configured while BFR is configured.

|  |
| --- |
| Agreement* The new beam RS is mandatorily configured if SCell BFR is configured
 |

One more comment on the implicit configuration. To our understanding, only explicit CBD-RS configuration is supported. CBD-RS (candidateBeamRSlist/ candidateBeamResourcelist) should be provided. Implicit configuration is not supported in the current specification.Others: |
| Samsung | Sub-topic 2-1: BFD on SCell* Issue 2-2-1: Option-2 (the argument behind Option-1/1a is questionable for FR2 intra-band non-contiguous CA, in RF session, the decision has not yet been decided for independent BM or not. Prefer not to define requirement if BFD configured on more than one serving cell, but don’t introduce restriction as Option 1 or 1a.)
* Issue 2-1-2: Option-1 (see comment for Issue 2-2-1 above; For FR2 inter-band CA, RF session already agree on independent BM, however the scenario is far from completion in other more fundamental issues than this, suggest to discuss that in future meeting. )
* Issue 2-1-3: Option-1
* Issue 2-1-4: Option-1
* Issue 2-1-5: Option-1
* Issue 2-1-6: Prefer Option 2 (don’t have strong view for Option 1 and 2, but Option 2 will encourage gNB to have more clear configuration).
* Issue 2-1-7: Option 1 or 2 since RAN1 has clear conclusion on that, and notifying RAN1 about RAN4’s decision should only be based on clear RAN4 consensus on the benefits of introducing SSB-based BFD for SCell.

Sub-topic 2-2: CBD on SCell* Issue 2-2-1: Option 1 (for FR2 inter-band CA, RF session already agree on independent BM, however the scenario is far from completion in other more fundamental issues than this, suggest to discuss that in future meeting..)

Sub-topic 2-3: BFRQ* Issue 2-3-1: Option 1 or 2 (Why SCells with DL and UL is precluded in Option 2? Except that both option 1 and option 2 are acceptable.)
* Issue 2-3-2: we agree with Option 1

Sub-topic 2-4: UE Capability and Applicability* Issue 2-4-1: Option 1 (see above comments for Issue 2-2-1)
* Issue 2-4-2: Option 1 (since it follows RAN1 agreement, but maybe not explicitly needed to be duplicated in RAN4 requirement)
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| Qualcomm | **Sub-topic 2-1:**Issue 2-1-1: Support both option1 and option 1a. But prefer option 1a.Issue 2-1-2: Support option 1.Issue 2-1-3: support option 1.Issue 2-1-4: Support option 1.Issue 2-1-5: Support option 1.Issue 2-1-6: support option 2.Issue 2-1-7: In option 1, do you mean “revert RAN4 agreement by only allowing CSI-RS based BFD for SCell”? If yes, we support this proposal because RAN1 has already ruled out SSB based BFD for SCell.**Sub-topic 2-2:**Issue 2-2-1: Support option 1.**Sub-topic 2-3:**Issue 2-3-1: Support option 2.Issue 2-3-2: support option 1.**Sub-topic 2-4:**Issue 2-4-1: Support option 1.Issue 2-4-2: More clarification is needed before an agreement can be reached. If some RS resources are configured in SPCell but if they are implicitly configured as CBD-RS resources for SCell, won’t UE be required to perform BFD/CBD? |
| Huawei | Sub topic 2-1:Issue 2-1-1:We propose option 2. No restriction is introduced in RAN4.If option 1/1a was applied, then SCell BFR would always be disable for FR2 intra-band CA.Issue 2-1-2:No need to introduce such kind of restriction for BFD requirements. UE shall be able to perform BFD measurements on multiple FR2 cells if the number of SCells for BFR does not exceed the UE capability. RAN4 can further study whether the maximum number of SCells for BFR is separately indicated for FR1 and FR2.Issue 2-1-3:No need to introduce new sharing factor for BFD and CBD evaluation period due to BFR procedure on multiple FR1 SCellsIssue 2-1-4:Agree on option 1Issue 2-1-5:Agree on option 1Issue 2-1-6:Both option 1 and option 2 are fine for us.Sub topic 2-2:Issue 2-2-1:Same comments as issue 2-1-2Sub topic 2-3:Issue 2-3-1:We support option 3. No core requirement impact for Rel-16 BFRQ.The SCell link recovery test shall be designed for the purpose of verifying BFD and CBD measurement performance.Sub topic 2-4:Issue 2-4-1:For option 1, if no RAN4 performance requirement would be defined for more than 1 serving cell perform BFR procedure, there would be no SCell link recovery test. Without configuring PCell/PSCell, UE cannot be only configured with one SCell. Hence, at least two serving cells shall be configured for SCell link recovery test.Issue 2-4-2:We propose option 1 |
| Ericsson | Sub topic 2-1-7: We prefer option 1. We should follow RAN1 decision; it is only CSI-RS that is supported for BFD for SCell (and PCell). RAN2 has included the possibility to configure SSB as BFD-RS in the signaling, since it is allowed for RLM. Sub topic 2-3-1: We prefer option 1 or option 2: It is necessary to define at least the requirements corresponding to step 1 (beam failure event thought a dedicated SR-like PUCCH resources). It would be the similar requirements as periodic/semi-persistent L1-RSPR/L1-SINR reporting on PUCCH. No strong view on the test with step 2. Sub topic 2-3-2: Option 1 is fine. |
| Nokia, Nokia Shanghai Bell | **Sub-topic 2-1:**Issue 2-1-7: In general, RAN4 should follow RAN1 outcomes. Should clarify what Option 1: Revert RAN4 …” mean? |

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| R4-2000290 | MTK: The sentence shown as follows shall be further discussed based on conclusion of open issue discussion in issue 2-1-7.“The RS resource configurations in the set $\overbar{q}\_{0}$ on PCell or PSCell can be periodic CSI-RS resources and/or SSBs. RS resource configuration in the set $\overbar{q}\_{0}$ on SCell shall be periodic CSI-RS.” |
| Company B |
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| R4-2000291 | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic#2-1** | *Issue 2-1-1: Necessity of BFD procedure on multiple serving cell on the same FR2 band** Option-1 (MTK): For BFD and CBD requirements in FR2, only one serving cell is assumed to perform BFR procedure for one FR2 band.
* Option-1a (MTK, Qualcomm): In FR2, UE is assumed to measure BFD-RS transmitted on only one serving cell per FR2 band, which can be implicitly configured to other serving cells on the same FR2 band for BFD procedure:
	+ For SpCell is on a FR2 band, BFD-RS should be transmitted on the SpCell.
	+ For the FR2 band without SpCell, BFD-RS should be transmitted on only one of SCells in that band
* Option-2 (Samsung, Huawei): No restriction introduced in RAN4.

*[Moderator] No majority view observed. Suggest for further discussion, while it should also be noted that the number of SCells for BFR is already agreed to be a UE capability as RAN1 agreed:*

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| AgreementA UE can be configured to perform BFR for any configured SCells * The maximum number of SCells for which the UE performs BFR is a UE capability
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*With the above RAN1 agreement, not quite sure companies supporting Option 1/1a can compromise to Option 2.* *Tentative agreements: N/A* *Recommendations for 2nd round: Continue discussion or other ways for compromise.*  |
|  | *Issue 2-1-2: Sharing factor for BFD Time Period for FR2** Option-1 (MTK, Samsung, Qualcomm): No BFD evaluation period will be specified if BFR is configured over multiple FR2 intra-band cells:
	+ Sharing factor for BFD evaluation period due to BFD over multiple FR2 intra-band cells will not be introduced.
	+ FFS SCell BFD for FR2 inter-band FR2 CA.
* Option-2 (Huawei): No need to introduce such kind of restriction for BFD requirements. UE shall be able to perform BFD measurements on multiple FR2 cells if the number of SCells for BFR does not exceed the UE capability.

*[Moderator] For FR2 inter-band CA, RF session already agree on independent BM, however the scenario is far from completion in other more fundamental issues than this, suggest to FFS for FR2 inter-band CA. Seems Option 2 is not contradicting with Option 1, if company can accept FFS for FR2 inter-band CA, which should not be the near case for business deployment as far as we know.* *Tentative agreements: Suggest Option-1 as agreement, i.e.,** No BFD evaluation period will be specified if BFR is configured over multiple FR2 intra-band cells:
	+ Sharing factor for BFD evaluation period due to BFD over multiple FR2 intra-band cells will not be introduced.
	+ FFS SCell BFD for FR2 inter-band FR2 CA.

*Recommendations for 2nd round: Continue discussion if above tentative agreement is not agreed.*  |
|  | *Issue 2-1-3: Sharing factor for BFD Time Period for FR1** Option-1 (MTK, Samsung, Qualcomm): RAN4 supports introducing a sharing factor in the BFD and CBD evaluation period for SCells in FR1.
	+ The sharing factor is proportional to the number of SCells for which UE is performing BFD/CBD.
* Option-2 (Huawei): No need to introduce new sharing factor for BFD and CBD evaluation period due to BFR procedure on multiple FR1 SCells

*Tentative agreements: N/A* *Recommendations for 2nd round: Continue discussion on above options.*  |
|  | *Issue 2-1-4: RS within a deactivated SCC is implicitly configured as the BFD-RS for another activated SCell** Option 1 (MTK, Samsung, Qualcomm, Huawei): UE is not required to perform BFD on RS within a deactivated SCC which is implicitly configured as the BFD-RS for another activated SCell

*Tentative agreements:* * UE is not required to perform BFD on RS within a deactivated SCC which is implicitly configured as the BFD-RS for another activated SCell

*Recommendations for 2nd round: N/A.*  |
|  | *Issue 2-1-5: RS within an activated SCC is implicitly configured as the BFD-RS for another deactivated SCell** Option 1 (MTK, Samsung, Qualcomm, Huawei): UE is not required to perform BFD on RS within an activated SCC which is implicitly configured as the BFD-RS for another deactivated SCell.

*Tentative agreements:** UE is not required to perform BFD on RS within an activated SCC which is implicitly configured as the BFD-RS for another deactivated SCell.

*Recommendations for 2nd round: N/A* |
|  | *Issue 2-1-6: When more than 2 BFD-RSs are transmitted on a CC for current SCell and (implicitly configured for) other SCell** Option 1 (MTK, Huawei): UE is allowed only to perform beam failure detection on the BFD-RSs for current serving cell.
* Option 2 (MTK, Samsung, Qualcomm, Huawei): it is up to UE implementation to select two BFD-RSs in active BWP in current CC to perform BFD (either for current SCell or for other Sell(s)).

*Tentative agreements:** When more than 2 BFD-RSs are transmitted on a CC for current SCell and (implicitly configured for) other SCell, it is up to UE implementation to select two BFD-RSs in active BWP in current CC to perform BFD (either for current SCell or for other Sell(s)).

*Recommendations for 2nd round: N/A* |
|  | *Issue 2-1-7: RAN1 specification and RAN4 agreement mismatch for SSB-based BFD on SCell** Option-1 (MTK, Samsung, Qualcomm, Ericsson, Nokia): Revert RAN4 agreement by only of allowing CSI-RS based BFD for SCell;
* Option-2 (Samsung): Allowing SSB based BFD for SCell but no RAN4 requirement (core and test cases) to be defined.
* Option-3 (MTK): Define RAN4 requirements for SSB based BFD for SCell, but let RAN1 be notified about RAN4 agreement.

*[Moderator] Sorry for the wrong expression for Option-1, and companies’ understanding on option-1 is correct, i.e., RAN4 only allows CSI-RS based BFD for SCell.* *Tentative agreements: Agree on Option-1, i.e.,* * RAN4 revert previous agreement by only allowing CSI-RS based BFD for SCell, to align with RAN1 specification.

*Recommendations for 2nd round:* |
| **Sub-topic 2-2** | *Issue 2-2-1: Sharing factor for CBD Time Period** Option-1 (MTK, Samsung, Qualcomm): No CBD evaluation period will be specified if BFR is configured over multiple FR2 intra-band cells:
	+ Sharing factor for CBD evaluation period (due to CBD over multiple FR2 intra-band cells) will not be introduced.
	+ FFS SCell BFD for FR2 inter-band FR2 CA.
* Option-2 (Huawei): No need to introduce such kind of restriction for CBD requirements. UE shall be able to perform CBD measurements on multiple FR2 cells if the number of SCells for BFR does not exceed the UE capability.

*[Moderator] Similar to Issue 2-1-2, Option 2 is not contradicting with Option 1, if company can accept FFS for FR2 inter-band CA, which should not be the near case for business deployment as far as we know.**Tentative agreements: Suggest Option-1 as agreement, i.e.,** No CBD evaluation period will be specified if BFR is configured over multiple FR2 intra-band cells:
	+ Sharing factor for CBD evaluation period (due to CBD over multiple FR2 intra-band cells) will not be introduced.
	+ FFS SCell BFD for FR2 inter-band FR2 CA.

*Recommendations for 2nd round: N/A.* |
| **Sub-topic 2-3** | *Issue 2-3-1: RAN4 requirement defined for two step BFRQ mechanism** Option-1 (Samsung, Ericsson): For SCells with DL only and SCells with DL and UL, RAN4 requirement is defined for two step BFRQ mechanism,
	+ Step-1: UE reports beam failure event through a dedicated SR like PUCCH resource;
	+ Step-2: UE conveys new beam information (if identified) and failed CC index(es) via MAC-CE.
* Option-2 (Qualcomm, Ericsson, [Samsung]): RAN4 defines requirement for step 1 of BFR, where UE reports beam failure event through a dedicated SR like PUCCH resources, in SCells with DL only.
	+ No RRM core requirement is defined for UE conveying new beam information and failed CC indices via MAC-CE.
* Option-2a (Samsung): RAN4 defines requirement for step 1 of BFR, where UE reports beam failure event through a dedicated SR like PUCCH resources, in SCells with DL only and SCells with DL and UL.
	+ No RRM core requirement is defined for UE conveying new beam information and failed CC indices via MAC-CE.
* Option-3 (MTK, Huawei): No core requirement impact for Rel-16 BFRQ.
* Option-3a: No core requirement impact for Rel-16 BFRQ, and Step-1 and Step-2 of SCell BFRQ procedure which shall be defined in RAN1 specification can be verified in SCell link recovery test.

*[Moderator] Diverse views observed, while the key different whether or not step-1 (through dedicated SR like PUCCH) need core requirement. Based on our understanding, the reason why Rel-15 CFRA based link recovery has only requirement for BFD and CBD but not having requirement on CFRA procedure is because BFR-CFRA is already captured in random access requirement, so no duplication is needed. However, for SR like PUCCH, we don’t believe it is the same case to avoid core requirement. We would also like to ask “Why SCells with DL and UL is precluded in Option 2?”. Without that, Samsung is also okay with Option-2.* *Tentative agreements: Compromise to Option 2/2a**Recommendations for 2nd round: Further discussion if no agreement achieved in 1st round.*  |
| *Issue 2-3-2: BFRQ requirement details (if core requirement is agreed to be introduced)** Option-1 (Qualcomm, Samsung, Ericsson): After detecting beam failure in an Scell and determining that the L1-RSRP of one candidate beam in SCell is greater than the configured threshold, UE is required to transmit scheduling request in the PSCell within a period T
	+ Where T is equal to the periodicity of PUCCH that has been configured with schedulingRequestForBFR.

*[Moderator] Depending on previous issue, and furthermore, based on companies’ input in 1st round, more discussion is needed.* *Tentative agreements: N/A**Recommendations for 2nd round: Continue discussion to check majority view.*  |
| **Sub-topic 2-4** | *Issue 2-4-1: UE Capability of Number of SCells for BFR** Option-1 (MTK, Samsung, Qualcomm): RAN4 requirement should not block the possibility of configuring BFR on multiple SCells, and no RAN4 performance requirement will be defined for more than 1 serving cell perform BFR procedure.
* Option-2: It is left to UE implementation on how to down-select the activated SCell for BFR when the configured activated SCell for BFR exceeds the maximum number of SCell BFR by UE capability signalling.
* Option-3 (Huawei): if no RAN4 performance requirement would be defined for more than 1 serving cell perform BFR procedure, there would be no SCell link recovery test. Without configuring PCell/PSCell, UE cannot be only configured with one SCell. Hence, at least two serving cells shall be configured for SCell link recovery test.

*Tentative agreements: N/A**Recommendations for 2nd round: Continue discussion to check majority view.* |
| *Issue 2-4-2: CBD-RS not configured** Option-1 (MTK, Samsung, Huawei): UE is not required to perform BFD and CBD for a SCell which is not configured with CBD-RS resources.
* Option-2 (Qualcomm): More clarification is needed before an agreement can be reached. If some RS resources are configured in SPCell but if they are implicitly configured as CBD-RS resources for SCell, won’t UE be required to perform BFD/CBD?

*[Moderator] Besides the clarification question from company supporting option-2, we would like to clarify on expected RAN4 impact if Option-1 is adopted. We expect RAN1 specification should capture that.* *Tentative agreements: N/A**Recommendations for 2nd round: Continue discussion to check majority view.*  |

*Suggestion on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | As suggested above, a single WF is preferred to cover eMIMO RRM. |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2000290 | Continue to receive detailed comments from companies except the open issues listed above. |
| R4-2000291 | Continue to receive detailed comments from companies except the open issues listed above. |

## Discussion on 2nd round (if applicable)

*The 2nd round discussion is under the topic of WF drafting, while the discussion history is captured here for information.*

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| --- |
| Sub-topic 2-1: BFD on SCell* **Necessity of BFD procedure on multiple serving cell on the same FR2 band**
	+ No restriction introduced in RAN4. No RAN4 performance requirement will be defined for performing BFD measurement on more than 1 serving cell ~~per band~~.
	+ [Moderator] Based on the discussion for SCell BFR UE capability, seems no restriction is needed in RAN4 for multiple serving cell on the same FR2 band. On the other hand, majority companies’ view is no RAN4 performance requirement will be defined for more than 1 serving cell perform BFR procedure. In other words, if SCell BFR is configured over multiple SCells which is allowed by UE capability, the NW configuration is allowed, while no RAN4 requirement will guarantee the performance.
	+ [MTK] The current wording on “perform BFR procedure”is not clear enough.
		- Fist, BFD-RS can be configured implicitly, which means if BFD-RS list is not provided for CC#1, UE will perform BFD on the TCIstate of PDCCH of CC#1. As a result, for CA, it seems BFD procedure will be performed on all CCs. And it is strange to say no BFD requirement for CA scenario.
		- Second, another scenario could be, FR1:PSCell#1 & SCell#1 and FR2: SCell#2. In this case, BFD on only one serving cell is not enough.
		- Therefore, we would suggest the wording like “performing BFD measurement on more than 1 serving cell **per band**.”.
	+ [Moderator2] To MTK:
		- Why the tentative agreement restrict BFD for CA scenario? Pls. notice the sub-bullet is under the main bullet, i.e., “Necessity of BFD procedure on multiple serving cell on the same FR2 band”
		- “per-band” is not needed, because it is already very clearly say in the main bullet, i.e., “on the same FR2 band”. In other words, the sub-bullet is to discuss something for “multiple serving cells on the same FR2 band”, even further than”per-band”. We don’t need to repeat main bullet.
		- To you second comment, again, pls. not the main bullet, we are discussing “multiple serving cell on the same FR2 band”, your example should not be this case, right?
		- Pls check the revised tentative agreement is okay or not.
* **Sharing factor for BFD Time Period for FR1 and FR2**
	+ No BFD evaluation period will be specified for performing BFD measurement on more than 1 serving cell per band:
		- Sharing factor for BFD evaluation period due to BFD over multiple Sells will not be introduced for FR2 intra-band CA
		- No RAN4 performance requirement will be defined for more than 1 serving cell per band perform BFD measurement
		- FFS Sharing factor for BFD evaluation period for FR1 CA , FR2 inter-band CA and FR1-FR2 CA.
	+ [Moderator] Based on previous tentative agreement, seem the above tentative agreement is reasonable.
	+ [MTK] The current wording on “BFR is configured over multiple SCells”is not clear enough.
		- As discussed in the above issue, BFD-RS can be configured implicitly, so it will be always configured over multiple SCells in CA scenario.
		- Therefore, we would suggest the wording like “performing BFD measurement on more than 1 serving cell **per band**.”, and then no sharing factor will be needed for one **FR2 intra band**.
		- For FR1, we think the sharing factor would be needed for multiple bands, e.g. FR1-FR2 combinations. For FR2 inter-band CA, the requirement should be revisited if FR2 inter-band scenario is introduced. But not sure it is agreeable to companies, so I add FFS as 3rd sub-bullet.
	+ [Huawei] We are fine with no requirements for more than 1 serving cell per band. However, the following aspects need to be further clarified:
		- When a PCC or PSCC is within a band, does UE is not required to perform BFD on SCCs in the same band?
		- Assuming that CC1 and CC2 are within the same band, if BFD-RS#1 for CC1 and BFD-RS#2 for CC2 are both transmitted on CC1, does UE only need to perform BFD measurement on BFD-RS#1, or on both BFD-RS#1 and BFD-RS#2
	+ [Moderator2] To MTK, pls. find my revision above. We are okay with your revision. To Huawei, I assume the above MTK’s revision can also solve your concern, i.e., no requirement for BFD “on” more than 1 serving cell per band, including both SpCell and SCell.
* **When more than 2 BFD-RSs are transmitted on a CC for current SCell and (implicitly configured for) other SCell**
	+ When more than 2 BFD-RSs are transmitted on a CC for current SCell and (implicitly configured for) other SCell, it is up to UE implementation to select two BFD-RSs in active BWP in current CC to perform BFD (either for current SCell or for other Sell(s)).
	+ [Moderator] Suggest the above tentative agreement based on majority view. Huawei is asked to check the above tentative agreement.
	+ [Huawei] We can agree on the above agreement.
	+ [Moderator2] Thank you for checking.

Sub-topic 2-2: CBD on SCell * **Sharing factor for CBD Time Period**
	+ No CBD evaluation period will be specified for performing CBD measurement on more than 1 serving cell per band:
		- Sharing factor for CBD evaluation period (due to CBD over multiple SCells) will not be introduced for FR2 intra-band CA.
		- No RAN4 performance requirement will be defined for more than 1 serving cell perform CBD measurement.
		- FFS Sharing factor for CBD evaluation period for FR1 CA , FR2 inter-band CA and FR1-FR2 CA.
	+ [Moderator] Based on previous tentative agreement, seem the above tentative agreement is reasonable.
	+ [MTK] Same coments as “Sharing factor for BFD Time Period for FR1 and FR2”. It should be clarified as “1 serving cell per band”
	+ [Moderator2] Same revision based on MTK’s revision.

Sub-topic 2-3: SCell Beam Failure Recovery ReQuest (BFRQ) Mechanism* **RAN4 requirement defined for two step BFRQ mechanism**
	+ RAN4 FFS whether and how the requirement could be defined for step 1 of BFR, where UE reports beam failure event through a dedicated SR like PUCCH resources:
		- No RRM core requirement is defined for UE conveying new beam information and failed CC indices via MAC-CE.
		- Applicable scenario:
			* Option-1: SCells with DL only and SCells with DL and UL
			* Option-2: SCells with DL only
	+ [Moderator] Suggest the above compromised proposed based on Option-2/2a. Companies can further check the applicable scenario in next meeting. Huawei and MTK are asked to check the above tentative agreement as compromise.
	+ [MTK] More discussion is needed. Unclear about how to define the starting time for the step 1 of BFR, and not sure it is testable, because NW does not know when new beam indication has been determined in UE side.
	+ [Huawei] We are still unclear which kind of RMM requirements need to be defined for BFRQ Step1. Measurement requirements, or delay requirements?
	+ [Ericsson] We support this way forward. We share the same view as moderator “the reason why Rel-15 CFRA based link recovery has only requirement for BFD and CBD but not having requirement on CFRA procedure is because BFR-CFRA is already captured in random access requirement, so no duplication is needed”. As specified in TS38.133 6.2.2.2.2 Non-Contention based random access, RAN4 specifies the beam failure recovery reporting requirements. Since BFRQ on SCell uses SR-like PUCCH resources instead of CFRA resource, we prefer RAN4 specify the corresponding requirements.
	+ [Moderator2] I changed the tentative agreement for more open discussion.
		- To MTK: pls refer to how we define requirement for random access triggered by BFR for Rel-15 CFRA-BFR in random access part. UE behavior is provided in core requirement. Your question is more related to how performance requirement is defined.
		- To Huawei: for step 1, for core requirement, UE behavior of step-1 will be specified.

[Qualcomm] We support the original proposal without the FFS. We agree with the moderator and think that this requirement is necessary.We agree with option 1 as the applicable scenario, i.e., “SCells with DL only and SCells with DL and UL”.* **FFS BFRQ requirement details, if the requirement of step-1 of BFR is agreed to be introduced:**
	+ Option-1: After detecting beam failure in an Scell and determining that the L1-RSRP of one candidate beam in SCell is greater than the configured threshold, UE is required to transmit scheduling request in the PSCell within a period T
		- Where T is equal to the periodicity of PUCCH that has been configured with schedulingRequestForBFR.
	+ Other options are not precluded.
	+ [Moderator] Depending on previous issue,
	+ [MTK] More discussion is needed. Unclear about how to define the starting time of T. Because NW does not know when new beam indication has been determined in UE side.
	+ [Huawei] The suggested BFRQ requirements seems to define the procedure for Step1, which I think shall be captured in RAN1’s spec TS38.213. The period T is configured by signaling.
	+ [Moderator2] Add the condition which depends on whether or not this requirement will be introduced. To Huawei, I assume you are talking about 38.321 for the procedure. To MTK, the requirement is about UE’s behavior, why NW know or not know the starting of T matters? Anyway, with the condition newly added, hope companies are okay with the proposal.
	+ [MTK2] we suggest to put this issue as FFS. If the starting time is unknown, then what’s the point to have requirement? Even it has specified certain delay requirement, because of the unknown starting time, network still doesn’t have idea about when the procedure can be completed.
	+ [Moderator3] Not all delay requirements are provided with networking knowing the start point, for instance, RLM, how NW knows UE will receive RLF from its lower layer, which is triggered by TE simulated low power in the test; however, we still define UE behaviors, right? We can name more in the list…. Anyway, we can compromise as FFS but only revising main bullet is not enough. See the further revision.

Sub-topic 2-4: UE Capability and Others* **UE Capability of Number of SCells for BFR:**
	+ RAN4 requirement should not block the possibility of configuring BFR on multiple SCells, and no RAN4 performance requirement will be defined for more than 1 serving cell per band perform BFD/CBD measurement.
	+ [Moderator] Tentative agreement based on majority view. Huawei is asked to check the above tentative agreement as compromise. Also related to 1st topic in 3.2.1 (BFD on SCell).
	+ [MTK] The current wording on “configuring BFR on multiple SCells”is not clear enough, as discussed in 3.2.1. Besides the wording on “configuring”, it should be clarified as “1 serving cell per band”
	+ [Huawei] We are fine to agree the above agreements.
	+ [Moderator2] To MTK, “configuring BFR” of course includes explicit and implicit configuration. Both are included in this proposal, any concern on that? We are okay with your revision.
* **When CBD-RS not configured, UE’s expected behavior:**
	+ FFS UE is not required to perform BFD and CBD for a SCell which is not configured with CBD-RS resources.
	+ FFS UE is required to perform BFD and CBD for a SCell if some RS resources are configured in SPCell but if they are implicitly configured as CBD-RS resources for SCell.
	+ [Moderator] FFS UE behavior.
	+ [MTK] For the 1st FFS, we are fine. To our understanding the 2nd FFS can be removed, because implicitly configured CBD-RS is not supported in current specification 38.213.
	+ [Moderator2] To MTK, I agree with you, but I think it could be not harmful to put another FFS here to allow company who raised concern in 1st round to double check. Is that okay to you?
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## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| R4-2000290 | Based on comments collected, moderator recommend that CR should be *postponed*. |
| R4-2000291 | Based on comments collected, moderator recommend that CR should be *postponed*. |

# Topic #3: DL/UL beam indication with reduced latency and overhead

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000292 | Samsung | Observation-1: RAN4 has not any conclusion on testability for different UL TX spatial filters.Proposal-1: No RAN4 RRM requirement is defined for spatial relation updates for AP-SRS via MAC-CEObservation-2: Based on the agreed RAN1 mechanism for simultaneous TCI states activation/selection across multiple CCs/BWPs, the following scenarios are considered: - Scenario-1: A set of TCI-state IDs for PDSCH are activated by a MAC CE for a set of CCs/BWPs;- Scenario-2: A TCI-state ID is activated for a CORESET by a MAC CE for a set of CCs/BWPs;- Scenario-3: Spatial Relation Info is activated for a SP/AP SRS resource by a MAC CE for a set of CCs/BWPs.Proposal-2: For the procedure of simultaneous TCI states activation/selection across multiple CCs/BWPs in Rel-16 eMIMO work item:- No new requirement is introduced for the simultaneous TCI states activation/selection. - Rel-15 active TCI state switching delay requirements shall still be followed if simultaneous TCI states activation or selection across multiple CCs/BWPs is performed. |
| R4-2002122 | Qualcomm  | Proposal 1: RAN4 defines requirements for activating TCI states simultaneously across multiple CCs/BWPs with a single MAC-CE command.Proposal 2: The decision whether to define MAC-CE based spatial relationship update for AP-SRS or not should be taken in ‘RRM core requirement enhancement’ section (Agenda Item: 8.15.1).Proposal 3: RAN4 to define requirements of MAC-CE based spatial relation update for AP-SRS.Proposal 4: RAN4 to prioritize defining requirements for the case where the spatial relation is QCL’d to (or the QCL chain contains) SSB or CSI-RS. Proposal 5: Re-use the known state definition for TCI state for known spatial relation.  |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1: Simultaneous TCI States Activation/Selection across Multiple CCs/BWPs

**Issue 3-1-1: Whether or not to introduce new Rel-16 requirement on simultaneous TCI states activation/selection across multiple CCs/BWPs**

* Proposals:
	+ Option 1: RAN4 defines requirements for activating TCI states simultaneously across multiple CCs/BWPs with a single MAC-CE command
	+ Option 2: No new requirement is introduced for the simultaneous TCI states activation/selection.
		- Rel-15 active TCI state switching delay requirements shall still be followed if simultaneous TCI states activation or selection across multiple CCs/BWPs is performed.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

### Sub-topic 3-2: MAC-CE based spatial relation update for aperiodic SRS

**Issue 3-2-1: RAN4 RRM requirement impact due to MAC-CE based spatial relation update for aperiodic SRS**

* Proposals:
	+ Option 1: RAN4 to define requirements of MAC-CE based spatial relation update for AP-SRS.
	+ Option 2: No new requirement is introduced for the simultaneous TCI states activation/selection.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 3-2-2: Prioritization for different SRS spatial relation update (if requirement is agreed to be introduced):**

* Proposals:
	+ Option 1: RAN4 to prioritize defining requirements for the case where the spatial relation is QCL’d to (or the QCL chain contains) SSB or CSI-RS.
		- Note by moderator: compared with spatial relation which is QCL’d to another SRS.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

**Issue 3-2-3: Known spatial relationship, if requirement is agreed to be introduced:**

* Proposals:
	+ Option 1: Re-use the known state definition for TCI state for known spatial relation.
* Recommended WF
	+ Companies’ views are collected in 1st round discussion.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| MTK | Sub topic 3-1: Issue 3-1-1:We agree Option 2, no new requirement is introduced for the simultaneous TCI states activation/selection.Sub topic 3-2:Issue 3-2-1:The requirements of MAC-CE based spatial relation update for AP-SRS should wait until the RRM core requirement enhancement section spends further time on this topic.Issue 3-2-2:This issue is also discussed in agenda item 8.15.1 for this meeting, so it can be deprioritized here.Issue 3-2-3:This issue is also discussed in agenda item 8.15.1 for this meeting, so it can be deprioritized here.Others: |
| Samsung | Sub-topic 3-1: Simultaneous TCI States Activation/Selection across Multiple CCs/BWPs* Issue 3-1-1: Option 2 (performance can be guaranteed if additional description is added for Rel-16 simultaneous activation/selection, as the sub-bullet suggests.)

Sub-topic 3-2: MAC-CE based spatial relation update for aperiodic SRS* Issue 3-2-1, 3-2-2, 3-2-3: it is okay to wait for 8.15.1’s conclusion.
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| Qualcomm | **Sub-topic 3-1:**Issue 3-1-1: Support option 1**Sub-topic 3-2:**Issue 3-2-1, 3-2-2, 3-2-3: We support option 1 in all these issues. However, these issues are also being simultaneously discussed in Rel-16 RRM enhancement session. We propose to discuss these issues in that agenda item and make agreements to avoid duplication efforts. |
| Ericsson | Sub topic 3-1-1: We would like to ask companies supporting Option 1 how the existing MAC-CE based TCI state switch delay is affected due the single MAC-CE based simultaneous TCI states activation/selection across multiple CCs/BWPs. For example, what is the expected behaver/requirements, if gNB activates simultaneous TCI states across 2 CCs? Sub topic 3-2-1/3-2-1/3-2-3: We support the proposal 2 by Qualcomm paper R4-2002122 * Proposal 2: The decision whether to define MAC-CE based spatial relationship update for AP-SRS or not should be taken in ‘RRM core requirement enhancement’ section (Agenda Item: 8.15.1).

We would like to avoid the similar discussion in the two agendas. |
| Nokia, Nokia Shanghai Bell | **Sub-topic 3-1:**Issue 3-1-1: No strong justification is provided for either of the options. We suggest FFS.Issues 3-2-1, 3-2-2, 3-2-3: it is reasonable to take the outcome of RRM core requirement enhancements into consideration.  |
| DCM | **Issue 3-1-1: Whether or not to introduce new Rel-16 requirement on simultaneous TCI states activation/selection across multiple CCs/BWPs**Option 2 is a baseline for discussion.**Issue 3-2-1: RAN4 RRM requirement impact due to MAC-CE based spatial relation update for aperiodic SRS**Option 1 is preferred. In the Rel. 15 specification, SP SRS is only one option for changing spatial relation update with MAC CE. If A-SRS can be used, it is beneficial. We can reuse outcome from Rel. 16 RRM enhancement discussion.**Issue 3-2-2: Prioritization for different SRS spatial relation update (if requirement is agreed to be introduced):**Option 1 is fine. SRS spatial relation update using TRS should be prioritized. |

### CRs/TPs comments collection

*[Moderator] No CRs/TPs submitted under this topic.*

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic#3-** | *Issue 3-1-1: Whether or not to introduce new Rel-16 requirement on simultaneous TCI states activation/selection across multiple CCs/BWPs** Option 1 (Qualcomm): RAN4 defines requirements for activating TCI states simultaneously across multiple CCs/BWPs with a single MAC-CE command
* Option 2 (MTK, Samsung, DCM): No new requirement is introduced for the simultaneous TCI states activation/selection.
	+ Rel-15 active TCI state switching delay requirements shall still be followed if simultaneous TCI states activation or selection across multiple CCs/BWPs is performed.
* Option 3 (Nokia): FFS

*[Moderator]: As suggested by Ericsson, companies supporting Option 1 are asked how the existing MAC-CE based TCI state switch delay is affected due the single MAC-CE based simultaneous TCI states activation/selection across multiple CCs/BWPs. For example, what is the expected behaver/requirements, if gNB activates simultaneous TCI states across 2 CCs? As Moderator, we suggest that use the sub-bullet in Option 2 to cover this case, if no different performance is expected for multiple CCs case.* *Tentative agreements: N/A**Recommendations for 2nd round: Continue the discussion based on above Ericsson’s suggestion and Moderator’s explanation on Option 2.*  |
| **Sub-topic 3-2** | *Issue 3-2-1: RAN4 RRM requirement impact due to MAC-CE based spatial relation update for aperiodic SRS** Option 1: RAN4 to define requirements of MAC-CE based spatial relation update for AP-SRS.
* Option 2: No new requirement is introduced for the simultaneous TCI states activation/selection.

*Issue 3-2-2: Prioritization for different SRS spatial relation update (if requirement is agreed to be introduced):** Option 1: RAN4 to prioritize defining requirements for the case where the spatial relation is QCL’d to (or the QCL chain contains) SSB or CSI-RS.
	+ Note by moderator: compared with spatial relation which is QCL’d to another SRS.

*Issue 3-2-3: Known spatial relationship, if requirement is agreed to be introduced:** Option 1: Re-use the known state definition for TCI state for known spatial relation.

*[Moderator] Considering parallel discussion in Agenda Item 8.15.1, the decision whether to define MAC-CE based spatial relationship update for AP-SRS or not should be taken in ‘RRM core requirement enhancement’ section, as suggested by companies.* *Tentative agreements: The decision whether to define MAC-CE based spatial relationship update for AP-SRS or not should be taken in ‘RRM core requirement enhancement’ section.**Recommendations for 2nd round: Continue the discussion if needed.*  |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | As suggested above, a single WF is preferred to cover eMIMO RRM.  |  |

### CRs/TPs

*[Moderator] No CRs/TPs submitted under this topic.*

## Discussion on 2nd round (if applicable)

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| Sub-topic 3-1: Simultaneous TCI States Activation/Selection across Multiple CCs/BWPs* **Simultaneous TCI States Activation/Selection across Multiple CCs/BWPs:**
	+ No new requirement is introduced for the simultaneous TCI states activation/selection.
		- Rel-15 active TCI state switching delay requirements shall still be followed if simultaneous TCI states activation or selection across multiple CCs/BWPs is performed.
	+ [Moderator] Tentative agreement based on majority view. Qualcomm and Nokia are asked to check the tentative agreement as compromise.
	+ [MTK] Opponents should provide more details on why the R15 delay requirement would need to be updated.
	+ [Nokia] Ok as a compromise.
	+ [Qualcomm] We agree with the above proposal.
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## Summary on 2nd round (if applicable)

*[Moderator] No CRs/TPs submitted under this topic.*