**3GPP TSG-RAN4 Meeting #107 R4-23xxxxx**

**Incheon, Korea (Republic Of), 22nd May 2023 - 26th May 2023**

**Agenda item:** 8.20.4

**Source:** Moderator (CMCC)

**Title:** Topic summary for [107][308] FS\_NR\_duplex\_evo\_Part3

**Document for:** Information

# Introduction

This thread focuses on adjacent channel co-existence evaluation for Rel-18 NR Duplex evolution SI and corresponds to agenda 8.20.2.1. Following lists the timeline for co-existence simulation. The target of this meeting is to finish all simulation assumptions and collect co-ex study results.

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| --- | --- | --- |
| date | RAN4 meeting | Target for high priority scenario |
| 2023-04 | RAN4#106bis | * Deadline for official calibration phase, note 1 * start collecting co-ex study results |
| **2023-05** | **RAN4#107** | * **deadline for completeness of all assumptions** * **collecting co-ex study results** |
| 2023-08 | RAN4#108 | * deadline for collection of simulation results * conclude co-existence results i.e. ACIR |
| 2023-10 | RAN4#108 bis | * final results check and summarizing |
| 2023-11 | RAN4#109 | * TR drafting |
| Note 1: companies that doesn’t show calibration results until this meeting could also provide final simulation results in future meeting but have to company with calibration results to confirm their simulation results are aligned with other companies.  Note 2: if no simulation result is received in RAN4 #108, corresponding scenario would be skipped in this SI or show analysis and conclusions based on the results from TR 38.828 | | |

# Topic #1: Simulation assumption

## Companies’ contributions summary

|  |  |  |
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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2307314**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307314.zip) | Qualcomm CDMA Technologies | Proposal 1: It is sufficient for RAN4 to study random UE deployments within the SBFD co-existence framework.  Proposal 2: RAN4 to agree on how to evaluate the interference components (inter-subband and adjacent) in the agreed NF model and whether the ACLR should be considered wholly, partially, or not at all.  Proposal 3: RAN4 to discuss how to model the increase in the Noise figure based on the agreed Noise Figure model when calculating the UE Tx power within the power control algorithm. |
| [**R4-2307701**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307701.zip) | Ericsson | TP to TR 38.858: Addition of coexistence simulation assumptions to Annex D  This contribution carries a text proposal to TR 38.858, Annex D with all simulation assumptions used for the adjacent carrier coexistence evaluation part of SBFD SI. The text proposal is created **based on agreements from last meeting**.  The text proposal is attached at the end of this contribution, and it is presented for approval. |
| [**R4-2307703**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307703.zip) | Ericsson | In this contribution we have identified a few technical issues and lack of technical background information. To progress the work, we propose following:  Proposal 1: Apply carrier configuration power scaling with bandwidth for all interference situations when ACLR and ACS is used to calculate interferer levels consistently.  Proposal 2: For FR1 BS set ACS to 46 dBc for all BS classes.  Proposal 3: RAN4 needs to increase priority for deployment cases where UE-to-UE interference impact coexistence.  Proposal 4: To confirm validity of the UE ACLR model, encourage UE vendors to capture some technical background information in TR 38.858 to justify back-off range of 10 dB. |
| [**R4-2308193**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308193.zip) | CMCC | Proposal 1: template to collect simulation results are listed as in above.  Proposal 2: simulation results for different deployment scenarios should be separated into different tables.  Observation 1: both power boosting options for antenna configuration 1 is OK for us although no power boosting is more preferred for us. |
| [**R4-2308785**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308785.zip) | Samsung | **Observation 1**: The CLI TR 38.828 concluded in all scenarios studied of FR1 and FR2, including Uma, Indoor, Micro, the problematic cross-link interference is gNB-gNB interference. The CLI TR also 38.828 concluded in both FR1 and FR2 that no performance degradation were observed for Indoor-to-Indoor scenario, and dynamic TDD can be used for Micro-to-Micro scenario.  **Observation 2**: The urban macro was agreed as high priority and had accomplished the assumptions and calibration discussions, which reflects it was the most concerned scenario in RAN4 adjacent channel co-ex discussion.  **Proposal 1: We propose RAN4 to discuss whether Uma-Uma results can be considered as ‘worst-case’ scenario for SBFD co-ex with legacy TDD DL in adjacent channel, considering:**   * **the TR 38.828 concluded the BS-to-BS interference is the most problematic CLI and Uma-Uma suffers most CLI, and** * **the Urban macro is listed as high priority and had completed calibration,**   **Observation 3**: In [6], the UMi gNB was assumed with tx power as 46 dBm/100MHz, which according to section 6.2 of TS 38.104, this gNB should be categorized into the wide area BS.  **Proposal 2: RAN4 to discuss whether the UMi BS assumed in [6] is WA BS or MR BS, and this would impact the assumptions like NF.**  **Observation 4**: The gNB blocking probability with its corresponding aggressor is shown in table below:   |  |  |  | | --- | --- | --- | | Victim gNB | Aggressor | Blocking probability | | FR1 Uma legacy gNB | FR1 SBFD gNB | 0.04% | | FR1 SBFD gNB | FR1 Uma legacy gNB | 0.04% | | FR2 Uma legacy gNB | FR2 SBFD gNB | No blocking observed | | FR2 SBFD gNB | FR2 Uma legacy gNB | No blocking observed |   **Observation 5**: The impact of noise figure degradation and blocking probability had been covered by co-ex study by using the agreed noise figure model.  **Observation 6**: It was agreed that different company would provide their own implementation with different isolation capacities. So that the total input power at the input of LNA differs from company to company due to different assumptions of implementations in feasibility study.  **Proposal 3: For SBFD -> legacy TDD DL case, the co-ex study results would be used to discuss whether or not SBFD gNB ACLR needs improvement.**  **Proposal 4: For legacy TDD DL -> SBFD UL case, the co-ex study results would be used to discuss whether or not SBFD gNB ACS needs improvement.**  **Observation 7**: For the case of TDD DL -> SBFD DL, which is assumed as legacy UE in co-ex study, both aggressor and victim are legacy stations. It means no RF impact could be concluded to this case. And also, RAN4 had not decided how to evaluate this case.  **Observation 8**: The assumptions we used in co-ex study, including all the proposed options for gNB power, UE power, grid shifts and all others, are supposed to be used in normal operation between two adjacent channel legacy TDD DL.  **Observation 9**: The “relative ACIR”, which is derived by ACLR and ACS of legacy gNB and UE, provides an acceptable performance degradation basis between two legacy DL for all different options in assumptions.  **Proposal 5: For TDD DL -> SBFD DL case, the performance degradation (including SINR in dB and/or throughput in percentage) can be evaluated by comparing it to the same form (SINR or throughput) of performance degradation between TDD DL -> TDD DL.**  **Proposal 6: RAN4 to agree on a template in this meeting, and following table is a candidate option from our side.**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Performance degradation**  **(SINR in dB, Throughput in %)** | | | **Performance degradation reference**  **(Note 2)** | **Choice of optional simulation parameters** | | **Relative ACIR (dB)**  **(Note 1)** | **Relative ACIR + step (dB)** | **Relative ACIR + 2\*step (dB)** | | e.g. FR1 Uma-Uma |  |  | 5% | SINR:  Throughput: |  |  |  |  | | 50% |  |  |  |  | |  | 5% |  |  |  |  | | 50% |  |  |  |  | |  |  | 5% |  |  |  |  |  | | 50% |  |  |  |  | |  | 5% |  |  |  |  | | 50% |  |  |  |  | | **Note 1**: Relative ACIR is derived from legacy ACLR and ACS of legacy BS and UE.  **Note 2**: For legacy TDD interfering SBFD cases, to report the performance degradation of legacy TDD DL interfering TDD DL with same assumptions. | | | | | | | | |   **Proposal 7: RAN4 to utilize offline activity to collect results between #107 and #108 meeting.** |

## Open issues summary

* + 1. Sub-topic 1-1 how to model NF modeling into co-existence simulation

**Issue 1-1-1: how to evaluate interference components (inter-subband and adjacent) in the NF modelling (Qualcomm, R4-2307314)**

* Proposals
  + Option 1: the ACLR should be considered wholly in NF modelling
  + Option 2: the ACLR should be considered partially in NF modelling
  + Option 3: the ACLR should not be considered in NF modelling at all
  + Option 4: TBD
* Recommended WF
  + TBD

**Issue 1-1-2: how to model the increase in the Noise figure based on the agreed Noise Figure model when calculating the UE Tx power within the power control algorithm. (Qualcomm, R4-2307314)**

* Proposals
  + Option 1: In simulation, power control scheme is only used to compensate path loss and doesn’t consider noise figure modelling. That’s the reason why final SINR for UL is less than assumed target SINR. But commercial UE UL SINR could meet target value according to power control scheme in 38.213.
  + Option 2: TBA
* Recommended WF

*Moderator note: option 1 is the agreement in last meeting and will be captured into TR, please further check whether this agreement is still applicable or not.*

* + 1. Sub-topic 1-2 ACLR/ACS modeling

**Issue 1-2-1: FR1 gNB ACS for all BS classes**

* Proposals
  + Option 1:46dBc for all BS classes. (Ericsson R4-2307703)
  + Option 2: TBA
* Recommended WF
  + TBD

**Issue 1-2-2: technical background information about UE ACLR model**

* Proposals
  + Option 1: To confirm validity of the UE ACLR model, encourage UE vendors to capture some technical background information in TR 38.858 to justify back-off range of 10 dB. (Ericsson R4-2307703)
  + Option 2: TBA
* Recommended WF
  + Option 1

**Issue 1-2-3: ACLR/ACS power scaling**

* Proposals
  + Option 1: Apply carrier configuration power scaling with bandwidth for all interference situations when ACLR and ACS is used, to calculate interferer levels consistently. (Ericsson R4-2307703)
  + Option 2: TBA
* Recommended WF
  + TBD

*Moderator note: previous agreements about ACLR and ACS scaling due to non-equal aggressor and victim BW is listed as below for information.*

|  |
| --- |
| The BS ACLR in FR1 is assumed as frequency flat with some detailed explanation below:   * when aggressor BW is narrower than victim, e.g. SBFD gNB -> legacy TDD gNB   + - equivalent ACLR is equal to normal ACLR * when aggressor BW is wider than victim, e.g. legacy gNB -> SBFD gNB   + - total received interference = Ptx – (ACLR + the ratio of aggressor BW to victim BW)     - for example, when aggressor is 100MHz and victim is 20MHz, the equivalent ACLR is 45+10\*log10(100/20)=51.9dB   Use flat ACS modelling in simulation for FR1 and FR2 gNB.   * when aggressor BW is narrower than victim, e.g. SBFD gNB -> legacy TDD gNB   + - equivalent ACS is equal to normal ACS * when aggressor BW is wider than victim, e.g. legacy gNB -> SBFD gNB   + - total received interference = Ptx – (ACS + the ratio of aggressor BW to victim BW) |

* + 1. Sub-topic 1-3 FR1 UMi scenario parameters

Background: the FR1 UMi gNB was assumed with tx power as 46 dBm/100MHz in last meeting for FR1, which according to section 6.2 of TS 38.104, this gNB should be categorized into the wide area BS.

**Issue 1-3-1: RAN4 to discuss whether the UMi BS assumed in R4-2305922 is WA BS or MR BS**

* Proposals
  + Option 1: MR BS and refer to MR BS spec requirements if needed
  + Option 2: WA BS considering the output power is larger than upper limit of specified MR and refer to WA BS spec requirements if needed
* Recommended WF
  + TBD
    1. Sub-topic 1-4 Scenario

**Issue 1-4-1: whether Uma-Uma results can be considered as ‘worst-case’ scenario for SBFD co-ex with legacy TDD DL in adjacent channel (Samsung)**

* Proposals
  + Option 1: Uma-Uma results can be considered as ‘worst-case’ scenario according to analysis in TR 38.828
  + Option 2: TBD
* Recommended WF
  + TBD

**Issue 1-4-2: random UE deployment or cluster-based deployment:**

* Proposals
  + Option 1: It is sufficient for RAN4 to study random UE deployments within the SBFD co-existence framework. (Qualcomm)



Figure 2 Interference power for different UE deployments

* + Option 2: RAN4 needs to increase priority for deployment cases where UE-to-UE interference impact coexistence (Ericsson R4-2307703)
* Recommended WF
  + TBD
    1. Sub-topic 1-5 evaluation methods on co-ex study

**Issue 1-5: Evaluation methods on co-ex study**

* Proposals
  + Option 1: For SBFD -> legacy TDD DL case, the co-ex study results would be used to discuss whether or not SBFD gNB ACLR needs improvement. (Samsung)
  + Option 2: For legacy TDD DL -> SBFD UL case, the co-ex study results would be used to discuss whether or not SBFD gNB ACS needs improvement. (Samsung)
  + Option 3: For TDD DL -> SBFD DL case, the performance degradation (including SINR in dB and/or throughput in percentage) can be evaluated by comparing it to the same form (SINR or throughput) of performance degradation between TDD DL -> TDD DL. (Samsung)
* Recommended WF

Moderator note: above options don’t conflict each other. Please discuss above options one by one.

1. Topic #2: Collection of simulation results

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

* 1. Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2307056**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307056.zip) | CableLabs, Charter Communications | Observation 1: 100% grid offset in the baseline assumptions maximizes the BS-to-BS distance between two adjacent-channel networks, so it is the best case to minimize the BS-to-BS interference. Coexistence with different grid offset values should be studied in RAN4.  Observation 2: The 5th percentile TDD UL throughput in the FR1 UMa-to-UMa scenario with 100% grid offset (289 m) degrades by 12% due to SBFD ACI, and the degradation increases to 100% with 50% or smaller grid offset values.  Observation 3: The 50th percentile TDD UL throughput in the FR1 UMa-to-UMa scenario with 100% grid offset (289 m) degrades by 4% due to SBFD ACI, and the degradation increases to 10%, 23%, 43%, and 62% when the grid offset is reduced to 50% (144 m), 25% (72 m), 10% (29 m), and 5% (14 m).  Observation 4: Based on the BS conducted power of 46 dBm/100MHz BS antenna size of 2×2, the Prated,c,AC is 40 dBm. According to Table 6.2.1-1 in TS 38.104, a microcell BS is a wide-area BS. The BS receiver noise figure is 5 dB, and adjacent channel selectivity (ACS) is 46 dBc.  Observation 5: The 50th percentile TDD UL throughput in the FR1 UMa-to-UMi scenario with 100% grid offset (167 m) degrades by 17% due to SBFD ACI, and the degradation increases to 41% when the grid offset is reduced to 50% (83 m).  Observation 6: Band n77 BS EIRP density limit is 62 dBm/MHz per FCC rules (equivalent to 59 dBm aggressor BS power), this realistic EIRP is 10 dB higher than the baseline assumption in [3] and [6]. The 50th percentile TDD UL throughput in the FR1 UMa-to-UMi scenario with 100% grid offset (167 m) degrades by 40% due to SBFD ACI, and the degradation increases to 74% when the grid offset is reduced to 50% (83 m).  Proposal 1: Based on the simulation results from case 2 and scenarios 1 and 4, RAN4 should prohibit SBFD operation in FR1 UL slots to avoid detrimental BS-to-BS interference. |
| [**R4-2307314**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307314.zip) | Qualcomm CDMA Technologies | Proposal 1: It is sufficient for RAN4 to study random UE deployments within the SBFD co-existence framework.  Proposal 2: RAN4 to agree on how to evaluate the interference components (inter-subband and adjacent) in the agreed NF model and whether the ACLR should be considered wholly, partially, or not at all.  Proposal 3: RAN4 to discuss how to model the increase in the Noise figure based on the agreed Noise Figure model when calculating the UE Tx power within the power control algorithm.  Observation 1: For FR1 and TDD DL as a victim, no SINR or throughput degradation is observed when adjacent network is SBFD-capable compared to when the adjacent network is a TDD DL network.  Observation 2: For FR1 and SBFD DL as a victim, no SINR degradation is observed compared to legacy TDD DL network.  Observation 3: For FR1 and SBFD UL as a victim, SINR degradation is observed compared to legacy TDD DL network. It should be captured in the TR that latency reduction gains and UL coverage enhancements are expected with SBFD deployments.  Observation 4: For FR2, no SINR degradation is observed when the victim network is SBFD DL compared to legacy TDD DL network.  Observation 5: For FR2 and SBFD DL as a victim, no SINR degradation is observed compared to legacy TDD DL network.  Observation 6: For FR2 and SBFD UL as a victim, no SINR degradation is observed compared to legacy TDD DL network. |
| [**R4-2307391**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307391.zip) | CATT | This contribution summarizes the simulation results from our company. For FR1, it needs higher ACIR when NR TDD/SBFD UL is victim than NR TDD/SBFD DL is victim. For FR2, it is same as FR1 when NR TDD UL is victim, but it’s opposite when SBFD UL is victim. |
| [**R4-2307702**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307702.zip) | Ericsson | Observation 1: Coexistence of an SBFD network with a DL legacy TDD network is possible in a scenario where users are uniformly distributed. In this case, the UE-to-UE CLI does not cause harmful impact against the DL of the legacy network. However, this scenario may hide coexistence issues, because if users are uniformly distributed over a wide area, the probability that two users active in UL and DL at the same time are dropped close enough to each other to generate UE-to-UE CLI is extremely low.  Observation 2: For coexistence Case 1 is of interest to study as well the Urban Hotspot scenario: when the users are clustered, and the distance among them is reduced, it is higher the probability that users can interfere among each other. In this case, we observe that the DL mean user throughput is not affected by the coexistence with SBFD, but the 5%-tile throughput instead is, with up to 15% degradation with respect to the baseline. It is necessary to increase the ACIR of 20 dB with respect to the baseline, so up to 40 dB, in order to reduce the degradation to an acceptable value below 5%. Assuming the legacy TDD UE ACS cannot be changed, it is not possible to achieve such a high value of ACIR in reality.  Observation 3: The UL of a TDD network is highly impacted by the coexistence with an SBFD network. 20% degradation is observed in terms of mean user throughput, and 75% in terms of 5%-tile user throughput.  Observation 4: When blocking is not modelled at SBFD and TDD BS receivers, it is possible to find an ACIR value that allows to reduce the TDD UL mean user throughput and 5%-tile user throughput degradation. However, if the ACS of the legacy TDD BS is fixed at 46 dB, it is not possible to achieve the needed ACIR values to reduce the degradation (i.e., 56 and 66 dB for mean and 5%-tile user throughput, respectively).  Observation 5: When blocking is modelled at SBFD and TDD BS, approximately a 3% of blocking probability is observed, in case of uniform UE distribution, due to the CLI generated by the DL of SBFD neighbour operator. This probability of blocking harmfully impacts the UL performance of the TDD network in such a way that even increasing the ACIR, it is not possible to reduce the degradation to an acceptable level, below 5%, with respect to the baseline.  Observation 6: The UL of a SBFD network is highly impacted by the coexistence with a legacy TDD network. 17.4% degradation is observed in terms of mean user throughput, and 72% in terms of 5%-tile user throughput.  Observation 7: When blocking is not modelled at SBFD and TDD BS receivers, it is possible to find an ACIR value that allows to reduce the SBFD UL mean user throughput and 5%-tile user throughput degradation. However, if the ACLR of the legacy TDD BS is fixed at 45 dB, it is not possible to achieve the needed ACIR values to reduce the degradation (i.e., 56 and 66 dB for mean and 5%-tile user throughput, respectively).  Observation 8: When blocking is modelled at SBFD and TDD BS, approximately a 3% of blocking probability is observed, in case of uniform UE distribution, due to the CLI generated by the DL of legacy TDD neighbour operator. This probability of blocking harmfully impacts the UL performance of SBFD network in such a way that even increasing the ACIR, it is not possible to reduce the degradation to an acceptable level, below 5%, with respect to the baseline.  Observation 9: Coexistence of the UL of a TDD network with the DL an SBFD network is possible in a scenario where users are uniformly distributed. In this case, the UE-to-UE CLI does not cause harmful impact against the DL of the SBFD network. However, this scenario may hide coexistence issues, because if users are uniformly distributed over a wide area, the probability that two users active in UL and DL at the same time are dropped close enough to each other to generate UE-to-UE CLI is extremely low.  Observation 10: For coexistence Case 4 is of interest to study as well the Urban Hotspot scenario: when the users are clustered, and the distance among them is reduced, it is higher the probability that users can interfere among each other. In this case, we observe that the DL mean user throughput is not affected by the coexistence with SBFD, but the 5%-tile throughput instead is, with up to 12.2% degradation with respect to the baseline. It is necessary to increase the ACIR of 6 dB with respect to the baseline, so up to 34 dB, in order to reduce the degradation to an acceptable value below 5%. Assuming the legacy TDD UE ACLR cannot be changed, it is not possible to achieve such a high value of ACIR in reality.  Observation 11: In FR2 and coexistence case 1, similarly to what observed for FR1, it is important to study both urban macro and urban hotspot scenario. The uniform distribution of UEs may hide coexistence issues. Coexistence is possible when users are uniformly distributed, but when the users are clustered it is necessary to increase the ACIR to 24 dB, and consequently the ACLR of the SBFD UE.  Observation 12: In FR2 scenarios, for coexistence case 3, when the UL of SBFD is the victim and the DL of a legacy TDD system, coexistence is extremely sensitive to the assumptions that are made. When optimistic simulation assumptions and low transmission power are considered (e.g., LoS UMa, GS 100%, TRP 30 dBm), coexistence may be possible if SBFD BS ACS can be increased with respect to current assumptions. On the other hand, when more realistic assumptions in terms of LoS and GS are considered, and a higher TRP (40 dBm) is assumed, coexistence is challenging and is not possible in reality to achieve the ACIR needed to reach a tolerable degradation level.  Based on the detailed analysis of these results, we conclude the following:  1. FR1 scenarios are more challenging than FR2 for coexistence when CLI is involved, due to higher transmission power, and reduced directionality of transmissions compared to FR2.  2. FR1 scenarios where UL is the victim are impacted from both mean and 5%-tile throughput perspectives, since BS-to-BS CLI is the most limiting interference component.  3. DL FR1 is less vulnerable to CLI than UL. Scenarios where users are far away do not suffer from degradation of performance due to UE-to-UE CLI. However, when users are closer due to deployments that cluster them, 5%-tile throughput is impacted by coexistence.  4. FR2 coexistence results in both UL and DL are extremely sensitive to simulation assumptions: if the scenario considers users deployed far away from each other (uniform distribution), the GS is optimistically set to 100%, the transmission power is low, the LoS model tends to increase the isolation is BS-BS links, as is defined in the first priority assumptions, coexistence performance is quite optimistic. However, when less optimistic assumptions are considered, coexistence becomes more challenging, so that it is important to study more scenario configurations including different options, before drawing conclusions.  5. Assuming clustered UEs (hot spot scenario) we see impact for both FR1 and FR2. |
| [**R4-2307762**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307762.zip) | Huawei, HiSilicon | Observation: For FR1 Uma scenario, Co-existence between SBFD with ‘DU’ configuration and legacy TDD system brings non-negligible degradation to the UL performance. |
| [**R4-2308194**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308194.zip) | CMCC | In this contribution, our initial simulation results are listed as above. due to limited simulation period, we will update final simulation results in next meeting or late in this meeting. suggestion of ACIR for SBFD system will be provided after finishing all simulation scenarios and cases. |
| [**R4-2308629**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308629.zip) | Nokia, Nokia Shanghai Bell | Observation 1: For coexistence case 1 and Urban Macro scenario, the DL SINR at the victim NR TDD DL remains almost unchanged regardless of whether NR TDD or SBFD is acting as aggressor technology  Observation 2: For coexistence case 1 and Urban Hotspot scenario, the DL SINR at the victim NR TDD DL is further degraded with the presence of SBFD due to the adjacent channel UE-to-UE CLI  Observation 3: For coexistence case 1 and Urban hotspot scenario, the 5th and 50th percentiles DL SINR shows clear degradation when SBFD is used (as compared to when TDD DL is used)  Observation 4: For coexistence case 1 and Urban hotspot scenario, degradation of the DL throughput is observed in both 5th and 50th percentiles when the performance with an aggressor SBFD is compared to the performance of an aggressor TDD. In the 5th percentile, the DL throughput of the victim TDD subject to interference from an aggressor SBFD is approximately half of the throughput obtained when subject to interference from an aggressor TDD.  Observation 5: For coexistence case 2, when SBFD is the aggressor technology, there is UL SINR degradation in all percentiles for 10% or 100% grid shifts, when compared to the UL SINR when the victim is subject to interference from TDD.  Observation 6: Coexistence simulations shows that, for Case 4, there is impact on the victim SBFD DL SINR between having NR TDD DL or not as the aggressor technology in the adjacent channel.  Observation 7: Coexistence simulations shows that, for Case 4, the presence of DL transmissions on the adjacent channel show clear degradation of the SBFD UL SINR. |
| [**R4-2308785**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308785.zip) | Samsung | **Observation 1**: The CLI TR 38.828 concluded in all scenarios studied of FR1 and FR2, including Uma, Indoor, Micro, the problematic cross-link interference is gNB-gNB interference. The CLI TR also 38.828 concluded in both FR1 and FR2 that no performance degradation were observed for Indoor-to-Indoor scenario, and dynamic TDD can be used for Micro-to-Micro scenario.  **Observation 2**: The urban macro was agreed as high priority and had accomplished the assumptions and calibration discussions, which reflects it was the most concerned scenario in RAN4 adjacent channel co-ex discussion.  **Proposal 1: We propose RAN4 to discuss whether Uma-Uma results can be considered as ‘worst-case’ scenario for SBFD co-ex with legacy TDD DL in adjacent channel, considering:**   * **the TR 38.828 concluded the BS-to-BS interference is the most problematic CLI and Uma-Uma suffers most CLI, and** * **the Urban macro is listed as high priority and had completed calibration,**   **Observation 3**: In [6], the UMi gNB was assumed with tx power as 46 dBm/100MHz, which according to section 6.2 of TS 38.104, this gNB should be categorized into the wide area BS.  **Proposal 2: RAN4 to discuss whether the UMi BS assumed in [6] is WA BS or MR BS, and this would impact the assumptions like NF.**  **Observation 4**: The gNB blocking probability with its corresponding aggressor is shown in table below:   |  |  |  | | --- | --- | --- | | Victim gNB | Aggressor | Blocking probability | | FR1 Uma legacy gNB | FR1 SBFD gNB | 0.04% | | FR1 SBFD gNB | FR1 Uma legacy gNB | 0.04% | | FR2 Uma legacy gNB | FR2 SBFD gNB | No blocking observed | | FR2 SBFD gNB | FR2 Uma legacy gNB | No blocking observed |   **Observation 5**: The impact of noise figure degradation and blocking probability had been covered by co-ex study by using the agreed noise figure model.  **Observation 6**: It was agreed that different company would provide their own implementation with different isolation capacities. So that the total input power at the input of LNA differs from company to company due to different assumptions of implementations in feasibility study.  **Proposal 3: For SBFD -> legacy TDD DL case, the co-ex study results would be used to discuss whether or not SBFD gNB ACLR needs improvement.**  **Proposal 4: For legacy TDD DL -> SBFD UL case, the co-ex study results would be used to discuss whether or not SBFD gNB ACS needs improvement.**  **Observation 7**: For the case of TDD DL -> SBFD DL, which is assumed as legacy UE in co-ex study, both aggressor and victim are legacy stations. It means no RF impact could be concluded to this case. And also, RAN4 had not decided how to evaluate this case.  **Observation 8**: The assumptions we used in co-ex study, including all the proposed options for gNB power, UE power, grid shifts and all others, are supposed to be used in normal operation between two adjacent channel legacy TDD DL.  **Observation 9**: The “relative ACIR”, which is derived by ACLR and ACS of legacy gNB and UE, provides an acceptable performance degradation basis between two legacy DL for all different options in assumptions.  **Proposal 5: For TDD DL -> SBFD DL case, the performance degradation (including SINR in dB and/or throughput in percentage) can be evaluated by comparing it to the same form (SINR or throughput) of performance degradation between TDD DL -> TDD DL.**  **Proposal 6: RAN4 to agree on a template in this meeting, and following table is a candidate option from our side.**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Performance degradation**  **(SINR in dB, Throughput in %)** | | | **Performance degradation reference**  **(Note 2)** | **Choice of optional simulation parameters** | | **Relative ACIR (dB)**  **(Note 1)** | **Relative ACIR + step (dB)** | **Relative ACIR + 2\*step (dB)** | | e.g. FR1 Uma-Uma |  |  | 5% | SINR:  Throughput: |  |  |  |  | | 50% |  |  |  |  | |  | 5% |  |  |  |  | | 50% |  |  |  |  | |  |  | 5% |  |  |  |  |  | | 50% |  |  |  |  | |  | 5% |  |  |  |  | | 50% |  |  |  |  | | **Note 1**: Relative ACIR is derived from legacy ACLR and ACS of legacy BS and UE.  **Note 2**: For legacy TDD interfering SBFD cases, to report the performance degradation of legacy TDD DL interfering TDD DL with same assumptions. | | | | | | | | |   **Proposal 7: RAN4 to utilize offline activity to collect results between #107 and #108 meeting.**  For SBFD interfering legacy TDD DL:  **Observation 10**: No performance degradation of legacy TDD DL was observed by introducing SBFD in adjacent channel for both FR1 and FR2 Urban Macro scenario.  **Proposal 8: For SBFD system as aggressor, no performance degradation of legacy TDD DL relating to ACLR/ACS is observed.**  For legacy TDD DL interfering SBFD:  **Observation 11**: No performance degradation of SBFD UL was observed by introducing legacy TDD DL in adjacent channel for both FR1 and FR2 Urban Macro scenario.  **Observation 12**: Under certain assumptions, FR1 UE operating in SBFD DL would suffer >5% throughput loss (as shown in red arrow) at 5%-tile point when having legacy TDD DL operating in its adjacent channel. Under same assumptions, the FR1 UE operating in legacy TDD DL will suffer more throughput loss (as shown in blue arrow) at 5-tlie point when having legacy TDD DL operating in its adjacent channel.    **Proposal 9: For SBFD gNB as victim, no performance degradation relating to ACLR/ACS is observed when having legacy TDD DL in adjacent channel. For UE operating in SBFD DL as victim suffering from legacy TDD DL, the performance degradation would be lower than the UE operating in legacy DL suffering legacy TDD DL in adjacent channel.**  **Proposal 10: From adjacent channel co-ex study, the legacy gNB ACLR and ACS can be re-used for SBFD gNB when SBFD operating in TDD DL slot.**  **Proposal 11: RAN4 to discuss the TP to TR 38.858 on adjacent channel co-existence evaluation results in Appendix regarding the proposed skeleton of Section 11.** |
| [**R4-2309176**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309176.zip) | ZTE Corporation | Observation 1: the interference from FR1 NR TDD DL to SBFD DL @4GHz seems acceptable by reusing the existing requirement.  Observation 2: the interference from FR1 SBFD to NR TDD DL @4GHz seems acceptable by reusing the existing requirement.  Observation 3: performance loss for SBFD UL due to the interference from FR1 TDD DL to SBFD UL @4GHz are much higher than 5% throughput loss with baseline ACIR.  Observation 4: the interference from FR2 SBFD to NR TDD DL @30GHz seems around 15%  Observation 5: performance loss for SBFD UL due to the interference from FR2 TDD DL to SBFD UL @30GHz are a bit higher than 5% throughput loss with baseline ACIR. |

* 1. Open issues summary

***Moderator note: it’s immature to conclude any agreements based on current simulation results in this meeting. All proposals and observations from companies are listed in following corresponding sub-topic for information.***

Simulation cases for SBFD

Table 2-3: Coexistence cases

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Victim | Aggressor | Figures:  Aggressor(left) and Victim(right) | Aggressor baseline | Priority |
| NR TDD DL | SBFD (DU) | Case 1 | NR TDD DL | High |
| NR TDD UL | SBFD (DU) | Case 2 | NR TDD UL | Low |
| SBFD (DU) | NR TDD DL | Case 3 | No system in adjacent channel | High |
| SBFD(DU) | NR TDD UL | Case 4 |  | Low |

Table 2.1-1: Scenarios for SBFD co-ex study

|  |  |  |  |
| --- | --- | --- | --- |
| FR | Scenario No. | Deployment Scenario1  (Aggressor -> Victim) | Priority |
| FR1 (4GHz) | 1 | Urban Macro -> Urban Macro | High |
| 2 | Urban Hotspot -> Urban Hotspot | Note 4 |
| 3 | Indoor -> Indoor | Low |
| 4 | UMa-to-UMi | Note 5 |
| FR2  (30GHz) | 5 | Urban Macro -> Urban Macro | High |
| 6 | Urban Hotspot -> Urban Hotspot | Note 4 |
| 7 | Urban Micro -> Urban Micro | Low |
| 8 | Indoor -> Indoor | Low |
| Note 1: The Urban Macro is agreed as baseline scenario for SBFD co-ex study with high priority in RAN4#104-e, while it does not preclude other scenarios.  Note 2: The Urban Hotspot uses the same assumption as Urban Macro, except that Urban Macro uses random dropping method for UE while Urban Hotspot uses cluster-based dropping method for UE. Both random dropping and cluster-based dropping for calibration.  Note 3: Consider Urban Macro scenario first for calibration purpose.  Note 4: Companies are encouraged to provide simulation results for Urban Hotspot scenario as 2nd priority. [Editor’s Note: Agreement 2.2.1 of R4-2302888]  Note 5: Companies also encouraged to simulate Uma-to-UMi co-existence scenario as 2nd priority. [Editor’s Note: Agreement 2.2.3 of R4-2302888] | | | |

### Sub-topic 2-1 Template for collecting final simulaiton results

**Issue 2-1: template table for collecting final simulation results**

* Proposals
  + Option 1: simulation results for different deployment scenarios are suggested to be separated into different tables. Detailed template in R4-2308193 CMCC
  + Option 2: detailed template in R4-2308785 Samsung
* Recommended WF
  + RAN4 to utilize offline activity to collect results between #107 and #108 meeting.
  + One table per scenario per case
  + Company choice their own relative ACIR step value and there is no uniform value
  + Further discuss the table template based on following templates, template 1 is for case 1 and case 2, template 2 is for case 3 and case 4

*Template 1: simulation results for scenario X and case Y (aggressor: SBFD DU, victim: NR TDD UL/DL)*

Note: template 1 is only applicable for case 1 and case 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Observation point** |  | **Performance degradation** | | | **Choice of optional simulation parameters** |
|  |  |  | **Relative ACIR (dB)**  **(Note 1)** | **Relative ACIR + step (dB)** | **Relative ACIR + step (dB)** |  |
| Company A | 5% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |
| 50% | SINR degradation |  |  |  |
| Throughput degradation |  |  |  |
|  |  |  | **Relative ACIR (dB)**  **(Note 1)** | **Relative ACIR + step (dB)** | **Relative ACIR + step (dB)** |  |
| Company B | 5% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |
| 50% | SINR degradation |  |  |  |
| Throughput degradation |  |  |  |
| Note 1: Relative ACIR is derived from legacy ACLR and ACS of legacy BS and UE. | | | | | | |

Template 2: simulation results for scenario X and case Y (aggressor: NR TDD UL/DL, victim: SBFD DU)

Note: template 2 is only applicable for case 3 and case 4

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Victim** | **Observation point** |  | **Performance degradation**  **(SINR in dB, Throughput in %)** | | | **Performance degradation reference**  **(Note 2)** | **Choice of optional simulation parameters** |
|  |  |  |  | **Relative ACIR (dB)**  **(Note 1)** | **Relative ACIR + step (dB)** | **Relative ACIR + step (dB)** |  |  |
| Company A | SBFD DL | 5% | SINR degradation |  |  |  |  |  |
| Throughput degradation |  |  |  |  |
| 50% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |  |
| SBFD UL | 5% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |  |
| 50% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |  |
|  |  |  |  | **Relative ACIR (dB)**  **(Note 1)** | **Relative ACIR + step (dB)** | **Relative ACIR + step (dB)** |  |  |
| Company B | SBFD DL | 5% | SINR degradation |  |  |  |  |  |
| Throughput degradation |  |  |  |  |
| 50% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |  |
| SBFD UL | 5% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |  |
| 50% | SINR degradation |  |  |  |  |
| Throughput degradation |  |  |  |  |
| **Note 1**: Relative ACIR is derived from legacy ACLR and ACS of legacy BS and UE. | | | | | | | | |
| **Note 2**: For legacy TDD interfering SBFD cases, to report the performance degradation of legacy TDD DL interfering TDD DL with same assumptions. | | | | | | | | |

### Sub-topic 2-2 Scenario 1 FR1 Urban Macro -> Urban Macro (High priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

Moderator summarize all observations/simulation results as below, which is only for information and we can delay any conclusion until next meeting. Detailed data are also listed as follows.

* all the simulation results show SINR/throughput degradation is acceptable. Some results also show that there is no SINR/throughput degradation.
* One company propose that this scenario 1 may hide coexistence issues, because if users are uniformly distributed over a wide area, the probability that two users active in UL and DL at the same time are dropped close enough to each other to generate UE-to-UE CLI is extremely low. But another company show that inter-UE CLI is almost the same for random UE distribution or cluster-based UE distribution and it is sufficient for RAN4 to study random UE deployments within the SBFD co-existence framework.
* **Observation 1: from Qualcomm in R4-2307314**

Table 3 SINR and throughput degradation for UMa FR1 deployment when victim is TDD DL

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Observation Point | **Victim:** Legacy TDD DL | |
| **Aggressor:** SBFD DUD | |
| SINR degradation (dB) | Throughput degradation (bps/Hz) |
| **Qualcomm Inc.** | 5% | 0 | 0 |
| 50% | -0.1 | 0.001 |
| 95% | -0.1 | -1 |

Observation 1: For FR1 and TDD DL as a victim, no SINR or throughput degradation is observed when adjacent network is SBFD-capable compared to when the adjacent network is a TDD DL network.

It is sufficient for RAN4 to study random UE deployments within the SBFD co-existence framework.



**Figure 2 Interference power for different UE deployments**

* **Observation 2: from Ericsson in R4-2307702**

Observation 1: Coexistence of an SBFD network with a DL legacy TDD network is possible in a scenario where users are uniformly distributed. In this case, the UE-to-UE CLI does not cause harmful impact against the DL of the legacy network. However, this scenario may hide coexistence issues, because if users are uniformly distributed over a wide area, the probability that two users active in UL and DL at the same time are dropped close enough to each other to generate UE-to-UE CLI is extremely low.

**Table 2.3-1: FR1 simulation results without blocking**

| **Deployment**  **scenario** | **Company** | **Case** | **Observation**  **Point** | **Baseline (Mbps)** | **Throughput (Mbps)** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Swept ACIR offset (dB)** | | | | | | | |
| **0** | **2** | **4** | **6** | **12** | **14** | **20** | **24** |
| 1 | Ericsson | 1 | 5% | 98.3 | 97.3 | 98.1 | 98.2 |  |  |  |  |  |
| 50% | 314 | 314 | 314 | 314 |  |  |  |  |  |
| 2 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 3 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 4 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 2 | Ericsson | 1 | 5% | 101.8 | 86.9 | 87 | 87.5 | 90.4 | 94.8 | 95.8 | 97.3 |  |
| 50% | 314 | 310 | 311 | 311 | 312 | 312 | 313 | 314 |  |
| 2 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 3 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 4 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |

* **Observation 3: from Huawei in R4-2307762**

**Table 1. Updated results for FR1 Uma SBFD (DU) co-ex with TDD from TDD DL perspective**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Aggressor | Victim | Observation Point | **SINR degradation (dB)** | **Throughput degradation (%)** |
| NR SBFD {DU}  80MHz DL + 20MHz UL | NR TDD 100MHz DL | 5% | 0.08 | 0.1 |
| 50% | 0.01 | - |
| 95% | - | - |

* **Observation 4: from CMCC in R4-2308194**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-30dB** | **- 20dB** | **- 10dB** | **Relative ACIR** | **+10dB** | **+20dB** | … |
| FR1 4GHz Uma-Uma | CMCC | 1  SBFDDL>TDDDL | 5% | 93.32 | 67.76 | 28.89 | 4.81 | 0.48 | 0.05 |  |  |  |
| 50% | 15.83 | 1.759 | 0.13 | 0.01 | 0.001 | 0 |  |  |
| Note 1: when SBFD as victim, it’s also suggested to report the TDD system throughput loss for the case when TDD interfere TDD using the same parameters as SBFD system. | | | | | | | | | | | | |

* **Observation 5: from Nokia in R4-2308629**

Observation 1: For coexistence case 1 and Urban Macro scenario, the DL SINR at the victim NR TDD DL remains almost unchanged regardless of whether NR TDD or SBFD is acting as aggressor technology

Table 1. Summary table with NR TDD DL relative throughput performance between aggressor baseline (DL TDD) and aggressor (SBFD) for coexistence case 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Scenario** | **Observation point** | **- 4dB** | **- 2dB** | **Relative ACIR** | **+ 2dB** | **+ 4dB** |
| Urban macro | 5th percentile | TBD | TBD | 0% | TBD | TBD |
| 50th percentile | TBD | TBD | +0.49% | TBD | TBD |

* **Observation 6: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
| FR1 Uma-Uma |  | 1 | 5% |  | 2.57 | 2.35 | 2.19 | 0.52 | 0.09 |  |  |  |
| 50% |  | 0.96 | 0.70 | 0.50 | 0.34 | 0.22 |  |  |
| Explanations: | | | | | | | | | | | | |
| -         The -4/-2/+2/+4 are the offset based on that relative ACIR.  -         For TDD DL -> SBFD DL case: The relative and offset ACIR is derived from TDD gNB ACLR and SBFD UE ACS; | | | | | | | | | | | | |

* **Observation 7: from Samsung in R4-2308785**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| / | **Relative ACIR** | / |
| FR1 Uma-Uma | Samsung | 1 | 5% | / | -0.25% | / | / | SBFD antenna configuration 1 with power boost. (option 1) |
| 50% | / | 0.24% | / | / |
|  |  | 1 | 5% | / | -0.75% | / | / | SBFD antenna configuration 2 |
| 50% | / | -0.52% | / | / |
| 50% | / | TDD DL 🡪 SBFD UL: 0.02%  SBFD DL: 1.03% | / | TDD DL 🡪 TDD DL: 1.12% |

**Observation 10**: No performance degradation of legacy TDD DL was observed by introducing SBFD in adjacent channel for both FR1 and FR2 Urban Macro scenario.

**Proposal 8**: For SBFD system as aggressor, no performance degradation of legacy TDD DL relating to ACLR/ACS is observed.

* **Observation 8: from ZTE in R4-2309176**

**Observation 2**: the interference from FR1 SBFD to NR TDD DL @4GHz seems acceptable by reusing the existing requirement.

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

Moderator summarize all observations/simulation results as below, which is only for information and we can conclude any agreement in next meeting. Detailed data are also listed as follows.

* At cell edge 5% point, simulation results show SINR/throughput degradation is larger than 5% for 100% grid shift, e.g. larger than 7.95% throughput loss among all companies. The degradation is even worse for less grid shift.
* at mean 50% point, some companies show degradation larger than 5% whereas others show the degradation is accepatable.
* **Observation 1: from CableLabs, Charter Communications in R4-2307056**

RAN4 should prohibit SBFD operation in FR1 UL slots to avoid detrimental BS-to-BS interference based on simulation results.

Observation 1: 100% grid offset in the baseline assumptions maximizes the BS-to-BS distance between two adjacent-channel networks, so it is the best case to minimize the BS-to-BS interference. Coexistence with different grid offset values should be studied in RAN4.

Observation 2: The 5th percentile TDD UL throughput in the FR1 UMa-to-UMa scenario with 100% grid offset (289 m) degrades by 12% due to SBFD ACI, and the degradation increases to 100% with 50% or smaller grid offset values.

Observation 3: The 50th percentile TDD UL throughput in the FR1 UMa-to-UMa scenario with 100% grid offset (289 m) degrades by 4% due to SBFD ACI, and the degradation increases to 10%, 23%, 43%, and 62% when the grid offset is reduced to 50% (144 m), 25% (72 m), 10% (29 m), and 5% (14 m).

Table 3. Throughput and SINR degradation due to FR1 UMa-to-UMa BS-to-BS ACI for 100% (289 m), 50% (144 m), 25% (72 m), 10% (29 m), and 5% (14 m) grid offset values.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment scenario number | Observation point | SNR (dB) | SINR baseline (dB) | SINR ACI (dB) | Spectrum efficiency SNR (bps/Hz) | Spectrum efficiency baseline (bps/Hz) | Spectrum efficiency ACI (bps/Hz) | SINR degradation (dB) | Spectrum efficiency degradation (%) | Choice of optional simulation parameters |
|  |
| 1: FR1 UMa-UMa | 5% | -2.4 | -8.0 | -8.6 | 0.26 | 0.08 | 0.07 | 0.6 | 12% | 100% grid offset (289 m) |  |
| 50% | 15.0 | 12.5 | 12.0 | 2.01 | 1.69 | 1.63 | 0.5 | 4% |  |
| 5% | -2.4 | -8.0 | -10.7 | 0.26 | 0.08 | 0.00 | 2.7 | 100% | 50% grid offset (144 m) |  |
| 50% | 15.0 | 12.5 | 11.1 | 2.01 | 1.69 | 1.52 | 1.4 | 10% |  |
| 5% | -2.4 | -8.0 | -14.3 | 0.26 | 0.08 | 0.00 | 6.3 | 100% | 25% grid offset (72 m) |  |
| 50% | 15.0 | 12.5 | 9.4 | 2.01 | 1.69 | 1.31 | 3.1 | 23% |  |
| 5% | -2.4 | -8.0 | -20.4 | 0.26 | 0.08 | 0.00 | 12.4 | 100% | 10% grid offset (29 m) |  |
| 50% | 15.0 | 12.5 | 6.3 | 2.01 | 1.69 | 0.96 | 6.2 | 43% |  |
| 5% | -2.4 | -8.0 | -25.5 | 0.26 | 0.09 | 0.00 | 17.5 | 100% | 5% grid offset (14 m) |  |
| 50% | 15.0 | 12.5 | 3.0 | 2.01 | 1.69 | 0.64 | 9.5 | 62% |  |

* **Observation 2: from Ericsson in R4-2307702**

Observation 3: The UL of a TDD network is highly impacted by the coexistence with an SBFD network. 20% degradation is observed in terms of mean user throughput, and 75% in terms of 5%-tile user throughput.

Observation 4: When blocking is not modelled at SBFD and TDD BS receivers, it is possible to find an ACIR value that allows to reduce the TDD UL mean user throughput and 5%-tile user throughput degradation. However, if the ACS of the legacy TDD BS is fixed at 46 dB, it is not possible in reality to achieve the needed ACIR values to reduce the degradation (i.e., 56 and 66 dB for mean and 5%-tile user throughput, respectively).

Observation 5: When blocking is modelled at SBFD and TDD BS, approximately a 3% of blocking probability is observed, in case of uniform UE distribution, due to the CLI generated by the DL of SBFD neighbour operator. This probability of blocking, together with the increase in noise figure, harmfully impacts the UL performance of the TDD network in such a way that even increasing the ACIR, it is not possible to reduce the degradation to an acceptable level, below 5%, with respect to the baseline.

**Table 2.3-1: FR1 simulation results without blocking**

| **Deployment**  **scenario** | **Company** | **Case** | **Observation**  **Point** | **Baseline (Mbps)** | **Throughput (Mbps)** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Swept ACIR offset (dB)** | | | | | | | |
| **0** | **2** | **4** | **6** | **12** | **14** | **20** | **24** |
| 1 | Ericsson | 1 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 2 | 5% | 16.4 | 3.97 | 5.5 | 7.3 | 9.1 | 12.9 | 13.4 | 14.9 | 16 |
| 50% | 33.6 | 26.9 | 27.8 | 28.8 | 29.8 | 31.8 | 32.1 |  |  |
| 3 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 4 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |

* **Observation 3: from Huawei in R4-2307762**

**Table 2. Updated results for FR1 Uma SBFD (DU) co-ex with TDD from TDD UL perspective**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Aggressor** | **Victim** | **Observation Point** | **SINR degradation (dB)** | **Throughput degradation (%)** |
| NR SBFD {DU}  80MHz DL + 20MHz UL | NR TDD 100MHz UL | 5% | 8.6 | - |
| 50% | 4 | 27 |
| 95% | 0.12 | 0.8 |

Observation: For FR1 Uma scenario, Co-existence between SBFD with ‘DU’ configuration and legacy TDD system brings non-negligible degradation to the UL performance.

* **Observation 4: from CMCC in R4-2308194**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-10dB** | **Relative ACIR** | **+10dB** | **+20dB** | **+30dB** | **+40dB** | **+50dB** |
| FR1 4GHz Uma-Uma | CMCC | 2  SBFD DL>TDDUL | 5% | 100 | 96.97 | 68.26 | 21.51 | 2.825 | 0.296 | 0.03 |  |  |
| 50% | 35.221722 | 6.0616167 | 0.6620113 | 0.0668615 | 0.0066935 | 0.0006694 | 6.694e-05 |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-10dB** | **- 5dB** | **Relative ACIR** | **+5dB** | **+10dB** | **+15dB** | **+20dB** |
| FR1 4GHz Uma-Uma | CMCC | 2  SBFD UL>TDDUL | 5% | 21.595193 | 8.6398213 | 2.9547854 | 0.9694374 | 0.3102962 | 0.0985054 | 0.0311885 |  |  |
| 50% | 0.0565462 | 0.0178941 | 0.0056599 | 0.0017899 | 0.0005660 | 0.0001790 | 5.660e-05 |  |

* **Observation 5: from Nokia in R4-2308629**

Observation 5: For coexistence case 2, when SBFD is the aggressor technology, there is UL SINR degradation in all percentiles for 10% or 100% grid shifts, when compared to the UL SINR when the victim is subject to interference from TDD.

Table 2. Summary table with NR TDD UL relative throughput performance between aggressor baseline (UL TDD) and aggressor (SBFD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Scenario** | **Observation point** | **- 4dB** | **- 2dB** | **Relative ACIR** | **+ 2dB** | **+ 4dB** |
| Urban macro – 100% grid shift | 5th percentile | TBD | TBD | - | TBD | TBD |
| 50th percentile | TBD | TBD | 51.53% | TBD | TBD |
| Urban macro – 10% grid shift | 5th percentile | TBD | TBD | - | TBD | TBD |
| 50th percentile | TBD | TBD | 82.93% | TBD | TBD |

* **Observation 6: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
| 50% |  | 0.96 | 0.70 | 0.50 | 0.34 | 0.22 |  |  |
| FR1 Uma-Uma |  | 2 | 5% |  | 12.66 | 10.89 | 7.95 | 3.11 | 0.52 |  |  |  |
| 50% |  | 4.93 | 3.97 | 3.15 | 2.59 | 2.13 |  |  |
| Explanations: | | | | | | | | | | | | |
| -         The -4/-2/+2/+4 are the offset based on that relative ACIR.  -         For TDD DL -> SBFD DL case: The relative and offset ACIR is derived from TDD gNB ACLR and SBFD UE ACS; | | | | | | | | | | | | |

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

Moderator summarize all observations/simulation results as below, which is only for information and we can conclude any agreement in next meeting. Detailed data are also listed as follows.

* Some companies only show results when DL or UL is victim, it’s suggested to show both cases in next meeting since this is the high priority
* When SBFD DL is victim, some results show the degradation is less than 5% whereas other companies results show larger than 5% throughput loss especially at cell edge 5% point.
* When SBFD UL is victim, some companies show worse SINR/throughput loss degradation whereas one company show the degradatoin is acceptable.
* **Observation 1: from Qualcomm in R4-2307314**
  + **SBFD DL as victim**

Table 3 SINR and throughput distributions for UMa FR1 deployment when victim is SBFD DL

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Observation Point | **Baseline: Victim:** TDD DL, **Aggressor:** TDD DL  **With SBFD: Victim:** SBFD DL, **Aggressor:** TDD DL | |
| SINR degradation (dB) | Throughput degradation (bps/Hz) |
| **Qualcomm Inc.** | 5% | 0.1 | 0.01 |
| 50% | 0.07 | 0.01 |
| 95% | -0.08 | 0 |

Observation 2: For FR1 and SBFD DL as a victim, no SINR degradation is observed compared to legacy TDD DL network.

* + **SBFD UL as victim**

Table 4 SINR and throughput distributions for UMa FR1 deployment when victim is SBFD UL

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Observation Point | **Baseline: Victim:** TDD UL, **Aggressor:** TDD UL  **With SBFD: Victim:** SBFD UL, **Aggressor:** TDD DL | |
| SINR degradation (dB) | Throughput degradation (bps/Hz) |
| **Qualcomm Inc.** | 5% | 9 | 0.3 |
| 50% | 4.2 | 0.5 |
| 95% | 1.8 | 0.2 |

Observation 3: For FR1 and SBFD UL as a victim, SINR degradation is observed compared to legacy TDD DL network. It should be captured in the TR that latency reduction gains and UL coverage enhancements are expected with SBFD deployments.

* **Observation 2: from Ericsson in R4-2307702**

Observation 6: The UL of a SBFD network is highly impacted by the coexistence with a legacy TDD network. 17.4% degradation is observed in terms of mean user throughput, and 72% in terms of 5%-tile user throughput.

Observation 7: When blocking is not modelled at SBFD and TDD BS receivers, it is possible to find an ACIR value that allows to reduce the SBFD UL mean user throughput and 5%-tile user throughput degradation. However, if the ACLR of the legacy TDD BS is fixed at 45 dB, it is not possible to achieve the needed ACIR values to reduce the degradation (i.e., 56 and 66 dB for mean and 5%-tile user throughput, respectively).

Observation 8: When blocking is modelled at SBFD and TDD BS, approximately a 3% of blocking probability is observed, in case of uniform UE distribution, due to the CLI generated by the DL of legacy TDD neighbour operator. This probability of blocking, together with the increment in resulting noise figure as defined by the blocking model, harmfully impacts the UL performance of SBFD network in such a way that even increasing the ACIR, it is not possible to reduce the degradation to an acceptable level, below 5%, with respect to the baseline.

**Table 2.3-1: FR1 simulation results without blocking**

| **Deployment**  **scenario** | **Company** | **Case** | **Observation**  **Point** | **Baseline (Mbps)** | **Throughput (Mbps)** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Swept ACIR offset (dB)** | | | | | | | |
| **0** | **2** | **4** | **6** | **12** | **14** | **20** | **24** |
| 1 | Ericsson | 1 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 2 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 3 | 5% | 10.1 | 2.77 | 3.59 | 4.58 | 5.62 | 8 | 8.8 | 9.57 | 9.87 |
| 50% | 27.87 | 23 | 23.7 | 24.5 | 25 | 26.4 | 26.7 |  |  |
| 4 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |

* **Observation 3: from Huawei in R4-2307762**

**Table 3. Updated results for FR1 Uma SBFD (DU) co-ex with TDD from SBFD DL perspective**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Aggressor** | **Victim** | **Observation Point** | **SINR degradation (dB)** | **Throughput degradation (%)** |
| NR TDD 100MHz DL | DL of NR SBFD {DU}  80MHz DL + 20MHz UL | 5% | 0.5 | 5.6 |
| 50% | 0.39 | 1.6 |
| 95% | 0.44 | 0 |

**Table 4. Updated results for FR1 Uma SBFD (DU) co-ex with TDD from SBFD UL perspective**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Aggressor** | **Victim** | **Observation Point** | **SINR degradation (dB)** | **Throughput degradation (%)** |
| NR TDD 100MHz DL | UL of NR SBFD {DU}  80MHz DL + 20MHz UL | 5% | - | - |
| 50% | 5 | - |
| 95% | 0.5 | 11 |

Observation: For FR1 Uma scenario, Co-existence between SBFD with ‘DU’ configuration and legacy TDD system brings non-negligible degradation to the UL performance.

* **Observation 4: from Nokia in R4-2308629**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Scenario** | **Observation point** | **- 4dB** | **- 2dB** | **Relative ACIR** | **+ 2dB** | **+ 4dB** |
| Urban macro - DL | 5th percentile | TBD | TBD | -10.33% | TBD | TBD |
| 50th percentile | TBD | TBD | -2.91% | TBD | TBD |
| Urban macro - UL | 5th percentile | TBD | TBD | - | TBD | TBD |
| 50th percentile | TBD | TBD | -51.67% | TBD | TBD |

Coexistence simulations shows that, for Case 4, there is impact on the victim SBFD DL SINR between having NR TDD DL or not as the aggressor technology in the adjacent channel.

Coexistence simulations shows that, for Case 4, the presence of DL transmissions on the adjacent channel show clear degradation of the SBFD UL SINR.

* **Observation 5: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
| 50% |  | 4.93 | 3.97 | 3.15 | 2.59 | 2.13 |  |  |
|  |  | 3(SBFD DL as victim) | 5% |  | 17.99 | 13.84 | 7.20 | 5.51 | 4.18 |  | 3.15 |  |
| 50% |  | 3.78 | 3.02 | 2.49 | 1.88 | 1.46 |  | 1.27 |
| Explanations: | | | | | | | | | | | | |
| -         The -4/-2/+2/+4 are the offset based on that relative ACIR.  -         For TDD DL -> SBFD DL case: The relative and offset ACIR is derived from TDD gNB ACLR and SBFD UE ACS; | | | | | | | | | | | | |

* **Observation 6: from Samsung in R4-2308785**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| / | **Relative ACIR** | / |
| 50% | / | -0.52% | / | / |
|  |  | 3 | 5% | / | TDD DL 🡪 SBFD UL: 5.30%  SBFD DL: 6.71% | / | TDD DL 🡪 TDD DL: 6.97% | SBFD antenna configuration 1 with power boost. (option 1) |
| 50% | / | TDD DL 🡪 SBFD UL: 3.41%  SBFD DL: 2.44% | / | TDD DL 🡪 TDD DL: 2.28% |
|  |  | 3 | 5% | / | TDD DL 🡪 SBFD UL: 4.37%  SBFD DL: 5.41% | / | TDD DL 🡪 TDD DL: 6.97% | SBFD antenna configuration 2 |
| 50% | / | TDD DL 🡪 SBFD UL: 2.02%  SBFD DL: 2.17% | / | TDD DL 🡪 TDD DL: 2.28% |
| 50% | / | TDD DL 🡪 SBFD UL: 0.02%  SBFD DL: 1.03% | / | TDD DL 🡪 TDD DL: 1.12% |

Observation 11: No performance degradation of SBFD UL was observed by introducing legacy TDD DL in adjacent channel for both FR1 and FR2 Urban Macro scenario.

Observation 12: Under certain assumptions, FR1 UE operating in SBFD DL would suffer >5% throughput loss (as shown in red arrow) at 5%-tile point when having legacy TDD DL operating in its adjacent channel. Under same assumptions, the FR1 UE operating in legacy TDD DL will suffer more throughput loss (as shown in blue arrow) at 5-tlie point when having legacy TDD DL operating in its adjacent channel.

Proposal 9: For SBFD gNB as victim, no performance degradation relating to ACLR/ACS is observed when having legacy TDD DL in adjacent channel. For UE operating in SBFD DL as victim suffering from legacy TDD DL, the performance degradation would be lower than the UE operating in legacy DL suffering legacy TDD DL in adjacent channel.

Proposal 10: From adjacent channel co-ex study, the legacy gNB ACLR and ACS can be re-used for SBFD gNB when SBFD operating in TDD DL slot.

* **Observation 7: from ZTE in R4-2309176**

**Observation 1**: the interference from FR1 NR TDD DL to SBFD DL @4GHz seems acceptable by reusing the existing requirement.

**Observation 3**: performance loss for SBFD UL due to the interference from FR1 TDD DL to SBFD UL @4GHz are much higher than 5% throughput loss with baseline ACIR.

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

There are not enough input results, more input is welcome and next meeting is the last meeting for results collection.

* **Observation 1: from Ericsson in R4-2307702**

**Observation 9:** Coexistence of the UL of a TDD network with the DL an SBFD network is possible in a scenario where users are uniformly distributed. In this case, the UE-to-UE CLI does not cause harmful impact against the DL of the SBFD network. However, this scenario may hide coexistence issues, because if users are uniformly distributed over a wide area, the probability that two users active in UL and DL at the same time are dropped close enough to each other to generate UE-to-UE CLI is extremely low.

**Table 2.3-1: FR1 simulation results without blocking**

| **Deployment**  **scenario** | **Company** | **Case** | **Observation**  **Point** | **Baseline (Mbps)** | **Throughput (Mbps)** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Swept ACIR offset (dB)** | | | | | | | |
| **0** | **2** | **4** | **6** | **12** | **14** | **20** | **24** |
| 1 | Ericsson | 1 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 2 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 3 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 4 | 5% | 109 | 109 | 109 | 109 |  |  |  |  |  |
| 50% | 332 | 331 | 331 | 331 |  |  |  |  |  |
| 2 | Ericsson | 1 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 2 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 3 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 4 | 5% | 77.8 | 68 | 68.3 | 73.2 | 74 |  |  |  |  |
| 50% | 326 | 322 | 323 | 324 | 325 |  |  |  |  |

* **Observation 2: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
|  |  | 4(SBFD UL as victim) | 5% |  | 16.16 | 13.89 | 12.46 | 10.89 | 5.26 |  | 4.26 |  |
| 50% |  | 5.71 | 4.63 | 3.78 | 3.02 | 2.42 |  | 0.85 |

### Sub-topic 2-3 Scenario 2 FR1 Urban Hotspot -> Urban Hotspot (2nd priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

Moderator summarize all observations/simulation results as below, which is only for information and we can delay any conclusion until next meeting. Detailed data are also listed as follows.

* Some companies show the SINR/throughput degradation is larger whereas other companies show the interference is acceptable.
* **Observation 1: from Ericsson in R4-2307702**

Observation 2: For coexistence Case 1, where DL TDD is the victim, it is of interest to study as well the Urban Hotspot scenario: when the users are clustered, and the distance among them is reduced, it is higher the probability that users can interfere among each other. In this case, we observe that the DL mean user throughput is not affected by the coexistence with SBFD, but the 5%-tile throughput instead is, with up to 15% degradation with respect to the baseline. It is necessary to increase the ACIR of by 20 dB with respect to the baseline, so up to 40 dB, in order to reduce the degradation to an acceptable value below 5%. Assuming the legacy TDD UE ACS cannot be changed, it is not possible to achieve such a high value of ACIR in reality.

**Table 2.3-1: FR1 simulation results without blocking**

| **Deployment**  **scenario** | **Company** | **Case** | **Observation**  **Point** | **Baseline (Mbps)** | **Throughput (Mbps)** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Swept ACIR offset (dB)** | | | | | | | |
| **0** | **2** | **4** | **6** | **12** | **14** | **20** | **24** |
| 2 | Ericsson | 1 | 5% | 101.8 | 86.9 | 87 | 87.5 | 90.4 | 94.8 | 95.8 | 97.3 |  |
| 50% | 314 | 310 | 311 | 311 | 312 | 312 | 313 | 314 |  |
| 2 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 3 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 4 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |

* **Observation 2: from Nokia in R4-2308629**
* Table 1. Summary table with NR TDD DL relative throughput performance between aggressor baseline (DL TDD) and aggressor (SBFD) for coexistence case 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Scenario** | **Observation point** | **- 4dB** | **- 2dB** | **Relative ACIR** | **+ 2dB** | **+ 4dB** |
| Urban hotspot | 5th percentile | TBD | TBD | -42.58% | TBD | TBD |
| 50th percentile | TBD | TBD | -12.17% | TBD | TBD |

Observation 2: For coexistence case 1 and Urban Hotspot scenario, the DL SINR at the victim NR TDD DL is further degraded with the presence of SBFD due to the adjacent channel UE-to-UE CLI

Observation 3: For coexistence case 1 and Urban hotspot scenario, the 5th and 50th percentiles DL SINR shows clear degradation when SBFD is used (as compared to when TDD DL is used)

Observation 4: For coexistence case 1 and Urban hotspot scenario, degradation of the DL throughput is observed in both 5th and 50th percentiles when the performance with an aggressor SBFD is compared to the performance of an aggressor TDD. In the 5th percentile, the DL throughput of the victim TDD subject to interference from an aggressor SBFD is approximately half of the throughput obtained when subject to interference from an aggressor TDD.

* **Observation 3: from Qualcomm in R4-2307314**
  + It is sufficient for RAN4 to study random UE deployments within the SBFD co-existence framework. (Qualcomm)



**Figure 2 Interference power for different UE deployments**

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

No input

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

No input

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

There are not enough input results, more input is welcome and next meeting is the last meeting for results collection.

* **Observation 1: from Ericsson in R4-2307702**

**Observation 10:** For coexistence Case 4 is of interest to study as well the Urban Hotspot scenario: when the users are clustered, and the distance among them is reduced, it is higher the probability that users can interfere among each other. In this case, we observe that the DL mean user throughput is not affected by the coexistence with SBFD, but the 5%-tile throughput instead is, with up to 12.2% degradation with respect to the baseline. It is necessary to increase the ACIR of 6 dB with respect to the baseline, so up to 34 dB, in order to reduce the degradation to an acceptable value below 5%. Assuming the legacy TDD UE ACLR cannot be changed, it is not possible to achieve such a high value of ACIR in reality.

**Table 2.3-1: FR1 simulation results without blocking**

| **Deployment**  **scenario** | **Company** | **Case** | **Observation**  **Point** | **Baseline (Mbps)** | **Throughput (Mbps)** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Swept ACIR offset (dB)** | | | | | | | |
| **0** | **2** | **4** | **6** | **12** | **14** | **20** | **24** |
| 2 | Ericsson | 1 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 2 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 3 | 5% |  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |  |
| 4 | 5% | 77.8 | 68 | 68.3 | 73.2 | 74 |  |  |  |  |
| 50% | 326 | 322 | 323 | 324 | 325 |  |  |  |  |

### Sub-topic 2-4 Scenario 3 FR1 Indoor -> Indoor (2nd priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

No input

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

No input

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

No input

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

No input

### Sub-topic 2-5 Scenario 4 FR1 UMa-to-UMi (2nd priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

No input

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

There is only one company’s input, the results show the interference is severe for case 2.

* **Observation 1: from CableLabs, Charter Communications in R4-2307056**

RAN4 should prohibit SBFD operation in FR1 UL slots to avoid detrimental BS-to-BS interference based on simulation results.

Observation 5: The 50th percentile TDD UL throughput in the FR1 UMa-to-UMi scenario with 100% grid offset (167 m) degrades by 17% due to SBFD ACI, and the degradation increases to 41% when the grid offset is reduced to 50% (83 m).

Table 4. Throughput and SINR degradation due to FR1 UMa-to-UMi BS-to-BS ACI for 100% (167 m) and 50% (83 m) grid offset values.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment scenario number | Observation point | SNR (dB) | SINR baseline (dB) | SINR ACI (dB) | Spectrum efficiency SNR (bps/Hz) | Spectrum efficiency baseline (bps/Hz) | Spectrum efficiency ACI (bps/Hz) | SINR degradation (dB) | Spectrum efficiency degradation (%) | Choice of optional simulation parameters |
|  |
| 4: FR1 UMa-UMi | 5% | -2.4 | -15.2 | -16.8 | 0.26 | 0.00 | 0.00 | 1.6 | N/A | 100% grid offset (167 m) WA BS |  |
| 50% | 15.0 | 3.7 | 2.4 | 2.01 | 0.69 | 0.58 | 1.3 | 17% |  |
| 5% | -2.4 | -15.3 | -20.0 | 0.26 | 0.00 | 0.00 | 4.8 | N/A | 50% grid offset (83 m) WA BS |  |
| 50% | 15.0 | 3.7 | 0.1 | 2.01 | 0.70 | 0.41 | 3.6 | 41% |  |

Observation 6: Band n77 BS EIRP density limit is 62 dBm/MHz per FCC rules (equivalent to 59 dBm aggressor BS power), this realistic EIRP is 10 dB higher than the baseline assumption in [3] and [6]. The 50th percentile TDD UL throughput in the FR1 UMa-to-UMi scenario with 100% grid offset (167 m) degrades by 40% due to SBFD ACI, and the degradation increases to 74% when the grid offset is reduced to 50% (83 m).

Table 5. Throughput and SINR degradation due to FR1 UMa-to-UMi BS-to-BS ACI for 100% (167 m) and 50% (83 m) grid offset values, and 59 dBm aggressor BS power.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment scenario number | Observation point | SNR (dB) | SINR baseline (dB) | SINR ACI (dB) | Spectrum efficiency SNR (bps/Hz) | Spectrum efficiency baseline (bps/Hz) | Spectrum efficiency ACI (bps/Hz) | SINR degradation (dB) | Spectrum efficiency degradation (%) | Choice of optional simulation parameters |
|  |
| 4: FR1 UMa-UMi | 5% | -2.4 | -15.2 | -20.4 | 0.26 | 0.00 | 0.00 | 5.2 | N/A | 100% grid offset (167 m) 59 dBm UMa BS power |  |
| 50% | 15.0 | 3.7 | 0.3 | 2.01 | 0.69 | 0.42 | 3.4 | 40% |  |
| 5% | -2.4 | -15.2 | -27.3 | 0.26 | 0.00 | 0.00 | 12.1 | N/A | 50% grid offset (83 m) 59 dBm UMa BS power |  |
| 50% | 15.0 | 3.7 | -4.3 | 2.01 | 0.70 | 0.18 | 8.0 | 74% |  |

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

No input

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

No input

### Sub-topic 2-6 Scenario 5 FR2 Urban Macro -> Urban Macro (high priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

Moderator summarize all observations/simulation results as below, which is only for information and we can delay any conclusion until next meeting. Detailed data are also listed as follows.

* Except for one company’s data, all other simulation results show SINR/throughput degradation is acceptable. Some results also show that there is no SINR/throughput degradation.

Moderator note: @ZTE, hi, Fei can you please give more explanation about the reason of larger degradation in your simulaiton results? My understanding is that the throughput loss baseline is different in your simulator. In our simulation, the additional throughput loss is caused only by UE-UE CLI i.e. the throughput loss baseline is considering adjacent TDD DL interference but it seems the additional throughput loss in your simulaiton results is caused by both gNB-UE CLI and UE-UE CLI, i.e. the throughput baseline is when there is no adjacent channel interference. Could you please show more clarification?

* Some companies show that even when coexistence is possible when users are uniformly distributed, but when the users are clustered it is necessary to increase the ACIR to 26 dB, which is not feasible assuming ACS of legacy UE is 23 dB. But another company show that inter-UE CLI is almost the same for random UE distribution or cluster-based UE distribution and it is sufficient for RAN4 to study random UE deployments within the SBFD co-existence framework.
* **Observation 1: from Qualcomm in R4-2307314**

Table 5 SINR and throughput degradation for UMa FR2 deployment when victim is TDD DL

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Observation Point | **Victim:** Legacy TDD DL | |
| **Aggressor:** SBFD DUD | |
| SINR degradation (dB) | Throughput degradation (bps/Hz) |
| **Qualcomm Inc.** | 5% | 0.03 | 0 |
| 50% | 0.1 | 0.01 |
| 95% | 0.1 | 0 |

Observation 4: For FR2, no SINR degradation is observed when the victim network is SBFD DL compared to legacy TDD DL network.

* **Observation 2: from Ericsson in R4-2307702**

**Observation 11**: In FR2 and coexistence case 1, similarly to what observed for FR1, it is important to study both urban macro and urban hotspot scenario. The uniform distribution of UEs may hide coexistence issues. Coexistence is possible when users are uniformly distributed, but when the users are clustered it is necessary to increase the ACIR to 26 dB, which is not feasible assuming ACS of legacy UE is 23 dB.

* **Observation 3: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
| FR2 Uma-Uma |  | 1 | 5% |  | 19.09 | 5.54 | 1.25 | 0.07 | 0.05 |  |  |  |
| 50% |  | 1.10 | 0.83 | 0.65 | 0.43 | 0.29 |  |  |

* **Observation 4: from CMCC in R4-2308194**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-20dB** | **- 10dB** | **Relative ACIR** | **+10dB** | **+20dB** |  | … |
| FR2 30GHz Uma-Uma | CMCC | 1  SBFD DL>TDD DL | 5% | 66.812991 | 27.501274 | 4.8093525 | 0.4976720 | 0.0468379 |  |  |  |  |
| 50% | 2.5035963 | 0.1790337 | 0.0143104 | 0.0013455 | 0.0001327 |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-20dB** | **- 10dB** | **Relative ACIR** | **+10dB** | **+20dB** |  | … |
| FR2 30GHz Uma-Uma | CMCC | 1  SBFD UL>TDD DL | 5% | 3.5177880e-05 | 3.5177901e-06 | 3.5177902e-07 | 3.5177908e-08 | 3.5178098e-09 |  |  |  |  |
| 50% | 1.8159290e-07 | 1.8159258e-08 | 1.8159320e-09 | 1.8159940e-10 | 1.8128898e-11 |  |  |  |

* **Observation 5: from Samsung in R4-2308785**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| / | **Relative ACIR** | / |
| FR2 Uma-Uma | Samsung | 1 | 5% | / | 2.04% | / | / | SBFD antenna configuration 1 with power boost. (option 1) |
| 50% | / | 0.19% | / | / |
|  |  | 1 | 5% | / | 1.81% | / | / | SBFD antenna configuration 2 |
| 50% | / | 0.14% | / | / |

Observation 10: No performance degradation of legacy TDD DL was observed by introducing SBFD in adjacent channel for both FR1 and FR2 Urban Macro scenario.

Proposal 8: For SBFD system as aggressor, no performance degradation of legacy TDD DL relating to ACLR/ACS is observed.

* **Observation 6: from ZTE in R4-2309176**

**Observation 4**: the interference from FR2 SBFD to NR TDD DL @30GHz seems around 15%

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

More inputs are welcome, and next meeting is the last meeting for results collection.

* **Observation 1: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
|  |  | 2 | 5% |  | 100.00 | 100.00 | 4.82 | 2.12 | 0.91 |  |  |  |
| 50% |  | 2.47 | 1.86 | 1.10 | 0.85 | 0.82 |  |  |

* **Observation 2: from CMCC in R4-2308194**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-20dB** | **- 10dB** | **Relative ACIR** | **+10dB** | **+20dB** | **+30dB** | **+40dB** |
| FR2 30GHz Uma-Uma | CMCC | 1  SBFD DL>TDD UL | 5% | 92.030843 | 40.629590 | 7.1056505 | 0.7895261 | 0.0798948 | 0.0079995 | 0.0008000 |  |  |
| 50% | 3.6812940 | 0.3859149 | 0.0388037 | 0.0038825 | 0.0003883 | 3.8827391e-05 | 3.8827413e-06 |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-20dB** | **-15dB** | **-10dB** | **-5dB** | **Relative ACIR** | **+5dB** | **+10dB** |
| FR2 30GHz Uma-Uma | CMCC | 1  SBFDUL>TDDUL | 5% | 28.815828 | 11.932588 | 4.2288326 | 1.4099705 | 0.4535658 | 0.1438917 | 0.0455489 |  |  |
| 50% | 0.2286446 | 0.0724667 | 0.0229357 | 0.0072549 | 0.0022944 | 0.0007256 | 0.0002294 |  |

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

Moderator summarize all observations/simulation results as below, which is only for information and we can conclude any agreement in next meeting. Detailed data are also listed as follows.

* Some companies only show results when DL or UL is victim, it’s suggested to show both case in next meeting since this is the high priority case.
* When SBFD DL is victim, the results are not aligned, some results show the degradation is less than 5% whereas other companies results show a little larger than 5% throughput loss especially at cell edge 5% point.
* When SBFD UL is victim, the results are not aligned, some results show the degradation is less than 5% whereas other companies results show a little larger than 5% throughput loss especially at cell edge 5% point..
* **Observation 1: from Qualcomm in R4-2307314**
  + **SBFD DL as victim**

Figure 8 SINR and throughput distributions for UMa FR2 deployment when victim is SBFD DL

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Observation Point | Baseline: Victim: TDD DL, Aggressor: TDD DL  With SBFD: Victim: SBFD DL, Aggressor: TDD DL | |
| SINR degradation (dB) | Throughput degradation (bps/Hz) |
| Qualcomm Inc. | 5% | 0.07 | 0.15 |
| 50% | 0.06 | 0.02 |
| 95% | -0.08 | 0 |

Observation 5: For FR2 and SBFD DL as a victim, no SINR degradation is observed compared to legacy TDD DL network.

* + **SBFD UL as victim**

Observation 6: For FR2 and SBFD UL as a victim, no SINR degradation is observed compared to legacy TDD DL network.

* **Observation 2: from Ericsson in R4-2307702**

Observation 12: In FR2 scenarios, for coexistence case 3, when the UL of SBFD is the victim and the DL of a legacy TDD system, coexistence is extremely sensitive to the assumptions that are made. When optimistic simulation assumptions and low transmission power are considered (e.g., LoS UMa, GS 100%, TRP 30 dBm), coexistence may be possible if SBFD BS ACS can be increased with respect to current assumptions. On the other hand, when more realistic assumptions in terms of LoS and GS are considered, and a higher TRP (40 dBm) is considered, coexistence is challenging and is not possible in reality to achieve the ACIR needed to reach a tolerable degradation level.

* **Observation 3: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
|  |  | 3(SBFD DL as victim) | 5% |  | 31.31 | 17.91 | 6.83 | 3.16 | 0.07 |  | 3.37 |  |
| 50% |  | 5.00 | 3.95 | 3.21 | 2.43 | 1.90 |  | 1.67 |

* **Observation 4: from CMCC in R4-2308194**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **-20dB** | **- 10dB** | **Relative ACIR** | **+10dB** | **+20dB** | **+30dB** | … |
| FR1 4GHz Uma-Uma | CMCC | 3  TDD DL>SBFD DL | 5% | 78.33 | 38.95 | 8.700 | 0.963 | 0.094 | 0.009 |  |  |  |
| 50% | 2.975 | 0.2028703 | 0.0153815 | 0.0014270 | 0.0001405 | 1.394e-05 |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| **Relative ACIR** | **5dB** | **10dB** | **15dB** | **+20dB** | **+25dB** | **+30dB** |
| FR1 4GHz Uma-Uma | CMCC | 3  TDD DL>SBFD UL | 5% | 79.46 | 56.70 | 31.26 | 13.57 | 4.838 | 1.593 | 0.511 |  |  |
| 50% | 0.144 | 0.046 | 0.014 | 0.0045674 | 0.0014444 | 0.0004568 | 0.0001444 |  |

* **Observation 5: from Samsung in R4-2308785**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | **TDD-TDD**  **with relative ACIR Note1** | **Choice of optional simulation parameters** |
| / | **Relative ACIR** | / |
|  |  | 3 | 5% | / | TDD DL 🡪 SBFD UL: 0.16%  SBFD DL: 4.62% | / | TDD DL 🡪 TDD DL: 4.78% | SBFD antenna configuration 1 with power boost. (option 1) |
| 50% | / | TDD DL 🡪 SBFD UL: 0.15%  SBFD DL: 1.13% | / | TDD DL 🡪 TDD DL: 1.12% |
|  |  | 3 | 5% | / | TDD DL 🡪 SBFD UL: 0.02%  SBFD DL: 4.10% | / | TDD DL 🡪 TDD DL: 4.78% | SBFD antenna configuration 2 |
| 50% | / | TDD DL 🡪 SBFD UL: 0.02%  SBFD DL: 1.03% | / | TDD DL 🡪 TDD DL: 1.12% |

Observation 11: No performance degradation of SBFD UL was observed by introducing legacy TDD DL in adjacent channel for both FR1 and FR2 Urban Macro scenario.

Observation 12: Under certain assumptions, FR1 UE operating in SBFD DL would suffer >5% throughput loss (as shown in red arrow) at 5%-tile point when having legacy TDD DL operating in its adjacent channel. Under same assumptions, the FR1 UE operating in legacy TDD DL will suffer more throughput loss (as shown in blue arrow) at 5-tlie point when having legacy TDD DL operating in its adjacent channel.

Proposal 9: For SBFD gNB as victim, no performance degradation relating to ACLR/ACS is observed when having legacy TDD DL in adjacent channel. For UE operating in SBFD DL as victim suffering from legacy TDD DL, the performance degradation would be lower than the UE operating in legacy DL suffering legacy TDD DL in adjacent channel.

Proposal 10: From adjacent channel co-ex study, the legacy gNB ACLR and ACS can be re-used for SBFD gNB when SBFD operating in TDD DL slot.

* **Observation 6: from ZTE in R4-2309176**

**Observation 5**: performance loss for SBFD UL due to the interference from FR2 TDD DL to SBFD UL @30GHz are a bit higher than 5% throughput loss with baseline ACIR.

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

More inputs are welcome, and next meeting is the last meeting for results collection.

* **Observation 1: from CATT in R4-2307391**
* Table 11: SBFD adjacent channel co-existence simulation results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Deployment scenario number** | **Company** | **Case number** | **Observation point** | **Relative ACIR is derived from legacy or baseline assumptions for legacy TDD and SBFD BS and UE.** | | | | | | | **TDD-TDD** | **Choice of optional simulation parameters** |
| **…** | **- 4dB** | **- 2dB** | **Relative  ACIR** | **+ 2dB** | **+ 4dB** | … | **with relative ACIR Note1** |
|  | 4 | 5% |  | 100.00 | 3.47 | 1.78 | 0.70 | 0.07 |  | 0.94 |  |
| 50% |  | 1.97 | 1.27 | 0.92 | 0.83 | 0.53 |  | 0.44 |

### Sub-topic 2-7 Scenario 6 FR2 Urban Hotspot -> Urban Hotspot (2nd priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

More inputs are welcome, and next meeting is the last meeting for results collection.

* **Observation 1: from Ericsson in R4-2307702**

**Observation 11**: In FR2 and coexistence case 1, similarly to what observed for FR1, it is important to study both urban macro and urban hotspot scenario. The uniform distribution of UEs may hide coexistence issues. Coexistence is possible when users are uniformly distributed, but when the users are clustered it is necessary to increase the ACIR to 26 dB, which is not feasible assuming ACS of legacy UE is 23 dB.

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

No input

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

No input

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

No input

### Sub-topic 2-8 Scenario 7 FR2 Urban Micro -> Urban Micro (2nd priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

No input

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

No input

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

No input

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

No input

### Sub-topic 2-9 Scenario 8 FR2 Indoor -> Indoor (2nd priority)

#### Case 1: aggressor SBFD DU victim NR TDD DL (high priority)

No input

#### Case 2: aggressor SBFD DU victim NR TDD UL (low priority)

No input

#### Case 3: aggressor NR TDD DL victim SBFD DU (high priority)

No input

#### Case 4: aggressor NR TDD UL victim SBFD DU (low priority)

No input

# Topic #3: Calibration results

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2309177**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309177.zip) | ZTE Corporation | updated calibration data collection |

## Open issues summary

Moderator note: list the updated calibration date into final WF for information.

# Topic #4: TP

Following lists the TP provided in this meeting.

|  |  |  |
| --- | --- | --- |
| [**R4-2307701**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307701.zip) | TP to TR 38.858: Addition of coexistence simulation assumptions to Annex D | Ericsson |
| [**R4-2308785**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308785.zip) | Discussions on SBFD co-ex study and draft TP to TR 38.858,  Draft TP in annex | Samsung |