**3GPP TSG-RAN WG4 Meeting #116 Draft R4-2512529**

**Bengaluru, India, 25th – 29th August 2025**

**Agenda item:** 7.21.1

**Source:** Charter Communications, Inc.

**Title:** Way Forward on UE-UE CLI problem statement and potential solutions

**Document for:** Approval

**Background:**

This document is provided to summarize a way forward because of the analysis on intra-operator adjacent-channel inter-cell UE-to UE CLI and solutions in thread [306] on Rel-19 work item on evolution of NR duplex operation (SBFD) for general aspect and for SBFD in RAN4#116.

Co-Existence assumptions and analysis for UE-To-UE CLI problem from WF in RAN4 #115

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| --- |
| * [Background] UE-to-UE CLI problem statement:   + The scenario to be considered:     - Intra-operator adjacent-channel inter-cell (i.e., both channels belong to a single operator)       * Use Urban Hotspot -> Urban Hotspot Scenario 2 as reference         + FFS non-located assumption is always valid or not         + detailed description provided in TR38.858   + The case to be considered:     - SBFD-aware UE (aggressor) UL transmission to NR TDD UE (victim) DL reception |
| * WF-1: Companies are encouraged to provided analysis on the above UE-to-UE CLI problem:   + The purpose is to identify whether the above-mentioned UE-to-UE CLI problem exists or not in the practical deployment   + One evaluation method is to re-perform RAN4 Rel-18 co-existence study on the above scenario/case     - Parameters agreed in Rel-18 will be reused unless difference identified     - FFS impact from different grid shift values     - FFS impact from ACLR model |
| * WF-2: Companies are encouraged to identify potential solution(s) to the above UE-to-UE CLI problem:   + Solution-1: Reduced p-max for SBFD-aware UE TX power by X dB.     - the reduced p-max is configurable per-UE     - FFS X dB is a single value or a configurable value or a configurable range   + Solution-2: SBFD configuration is set by using DUD (40%, 20%, 40%), or DU (by putting UL subband away from victim channel)   + Solution-3: Avoid scheduling the aggressor UE, up to BS implementation.   + Solution-4: Configure the aggressor UE fallback to TDD operation, up to BS implementation.   + Other new solutions (including the combination of the above-mentioned solutions) are encouraged to be provided, if any. |
| * WF-3: Companies are encouraged to provide analysis on solutions, by at least considering the following aspects:   + Benefit(s):     - At least for Solution-1, one evaluation method is to perform RAN4 co-existence study on the above scenario/case, by using XdB lower maximum UE power for aggressor UE(s)       * FFS how to determine one SBFD-aware UE is aggressor UE       * The value of X can be chosen from the range of [1, 5] and other values may not be precluded.       * How to determine the value of X or the range can be FFS       * Baseline to be compared to is Rel-18 coexistence study re-performed in WF-1       * Detailed parameters can be further discussed by conference call and/or email discussion before RAN4#116.     - Other methods are not precluded   + Limitation(s), e.g., decreased coverage for certain SBFD-aware UE, etc.   + Expected RAN4 requirement impact, including     - the impact to TS 38.104     - the impact to TS 38.101 series, e.g., Pcmax, etc.   + Expected RAN2 requirement impact:     - whether new or changed RAN2 signaling(s) is required:   + Expected RAN3 requirement impact:     - whether new or changed RAN3 signaling(s) is required: |

**WF1 and WF2 Solution 1**

Simulation Results (five companies)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | Simulation Assumptions | ACLR/ ACS | Pmax Reduction | TP degradation |
| Charter Comm. | Baseline (flat model) | Flat aclr 30 db acs 33 db | 0 db  5.5 db | 27.67%  5% |
| Step Size | Aclr 43 Db acs 33.6 db | 0 dB  3.5 dB | 11.58%  5% |
| Samsung | Step Size | Aclr 50 db acs 33.6 db | 0 db  3 db | 11.63%  2.92% |
| Optional assumptions (wall) | Wood  Concrete | 0 db  0 db | 7.6%  2.92% |
| Ericsson | Baseline case | Aclr 30 db acs33,6 db | 0 db  8 db | 31.49%  13% |
| Step size | Aclr 43 db acs 33.6 db | 0 db  8 db | 19.6%  9% |
| Nokia | Baseline | Aclr 30db acs 33db | 0 db  6 db | 50.84%  35% |
| Step size | Aclr 50 db acs 33.6 db | 0 db  6 dB | 38.64%  22.24% |

Table summary:

* flat models (Rel-18 assumptions) present worst-case scenarios
* Step size model (new assumptions) improves the performance but still shows TP degradation at UE max power
* Step size models with reduced Pmax values fixes or improves TP degradation

**Conclusions**

* UE-to-UE CLI for intra-operator adjacent-channel inter-cell UE-to UE CLI where one UE is legacy TDD, and the other UE is SBFD causes TP degradation
* Reducing the power of the SBFD UE reduces the TP degradation
* Propose for RAN4 to consider SBFD aggressor Pmax reduction for SBFD UE-to-UE CLI once other WG’s decide to address this issue in future releases

**WF1 WF2 Solution 2**

DUD SBFD configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Assumptions | DUD configuration | results |
| Qualcomm | Acir/aclr/acs 30 db/33 db/28 db | 40%/20%/40% | TP degradation is reduced |
|  |  |  |  |

**Conclusions**

* UE-to-UE CLI for intra-operator adjacent-channel inter-cell UE-to UE CLI where one UE is legacy TDD, and the other UE is SBFD causes TP degradation
* Limiting SBFD configurations provide guard bands and reduces UE-to-ue CLI, but it cannot be enforced through Standards

ISSDU have proposed several SBFD configurations to mitigate UE-to-ue CLI.

Four deployment configurations that satisfy the DL–DL boundary requirement:

* UD / DU
* UD / DUD
* DUD / DU
* DUD / DUD

RAN4 to restrict the frequency allocations of the third-party operator on both adjacent sides in the UD / DU scenario.

RAN4 to restrict the frequency allocations of the third-party operator on the left adjacent side in the UD / DUD scenario.

RAN4 to restrict the frequency allocations of the third-party operator on the right adjacent side in the DUD / DU scenario.

RAN4 to specify that no uplink restrictions from third-party adjacent-band operators are required in the DUD / DUD scenario.

**Conclusions:**

* UE-to-UE CLI for intra-operator adjacent-channel inter-cell UE-to UE CLI where one UE is legacy TDD, and the other UE is SBFD causes TP degradation
* Deployment configurations mitigate UE-To-UE CLI but will restrict SBFD operation
  + This proposal is not enforceable through Standards

**WF1 WF2 Solution 3**

Network scheduling

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| --- | --- | --- |
| Company | Assumptions | Results |
| Qualcomm | BS Network 1 schedules UE to SBFD  BS Network 2 schedules ue as legacy TDD | TP degradation observed  TP degradation avoided |

**Conclusions**

* UE-to-UE CLI for intra-operator adjacent-channel inter-cell UE-to UE CLI where one UE is legacy TDD, and the other UE is SBFD causes TP degradation
* Scheduling UEs between networks can avoid TP degradation because of scheduling SBFD UE’s away from legacy TDD UE’s.
  + This scheduling cannot be enforced through standards

**WF1 WF2 Solution 4**

* Configure the aggressor UE fallback to TDD operation (Nokia)

**Conclusions**

* UE-to-UE CLI for intra-operator adjacent-channel inter-cell UE-to UE CLI where one UE is legacy TDD, and the other UE is SBFD causes TP degradation
  + Configuring the aggressor UE fallback to TDD operation fixes TP degradation but this solution cannot be enforced through standards

**WF Summary**

* UE-to-UE CLI for intra-operator adjacent-channel inter-cell UE-to UE CLI where one UE is legacy TDD, and the other UE is SBFD causes TP degradation
  + Reducing the power of the SBFD UE reduces the TP degradation
    - Propose for RAN4 to consider SBFD aggressor Pmax reduction for SBFD UE-to-UE CLI once other WG’s decide to address this issue in future releases
  + Other solutions to mitigate UE-to-UE CLI reduces the TP degradation but cannot be enforceable through Standards
    - Limiting SBFD configurations to provide guard bands
    - Scheduling UEs between networks can avoid TP degradation because of scheduling SBFD UE’s away from legacy TDD UE’s.
    - Configuring the aggressor UE fallback to TDD operation cannot be enforced through standards