[RAN94e-R18Prep-17] In-Device Coexistence (IDC) Enhancements - Version 0.0.5
RAN

3GPP TSG RAN#94e RP-21xxxx

Electronic Meeting, December 6 - 17, 2021

Agenda Item:

Source: RAN2 chair (MediaTek)

Title: Moderator's summary for discussion [RAN94e-R18Prep-17] In-Device Coexistence (IDC) Enhancements

Document for: Discussion

1 Introduction

1.1 General

General Scope, Instructions, Deadline, Organization can be found in RP-212657, RP-212608.

The goal of the email discussion is to focus on potential scope/areas for each potential WI or SI. Aim to identify whether a topic should be a SI, or WI (including possibly a study phase for some scope(s)). Aim to identify the leading WG (including if any change compared with those in RP-212608) and the secondary WG(s). Aim to identify on the potential interaction with SA/CT. Critical to keep all items under rigorous check; important to avoid "number counting" driven discussion, but focus on tangible commercial interests.

Moderator: The discussion should establish objectives text and justifications text for input into a tentative WID. Can verify level of controversy per subarea/objectives. For IDC WI, to the extent possible, target scenarios should be determined.

1.2 Starting Status

The Starting status of the discussion on IDC is captured in RP-211666:

IDC is classified as a less contentious item:

***In-Device Co-existence (IDC) Enhancements (WI)**. An IDC enhancements WI, with the scope below seems acceptable*

IDC Enhancements (WI) Areas / Scope:

- *The interference between 3GPP and other RATs.*
  - *Enhanced FDM solution, which allows more flexible indication of affected frequencies (e.g. granularity of BWP or sub-band or PRB level). (RAN2)*

- *TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2)*

Note: MUSIM scheduling gap can be considered with TDM solution. LTE baseline can be considered. R4 MSD related objective may be considered when R4 discussions has converged.

1.3 Input Papers

For TSG RAN 93e there were also the following papers submitted:

RP-212289 Views on Rel-18 proposals on IDC Huawei, HiSilicon

RP-212032 In-device coexistence for NR Xiaomi Communications, T-Mobile USA, Deutsche Telekom, TELUS, Bell Mobility, Telstra, Telecom Italia, CMCC, China Telecom, China Unicom, Apple, Sony, TCL Communication Ltd., Spreadtrum Communications, OPPO, CATT, InterDigital

The input papers will not be explicitly treated here, but are mentioned for reference.

2 Initial Round

2.1 General

Moderator assumes that IDC is a mechanism that works as follows:

1. The UE detects internal issue or the possibility of internal issue caused by coexistence related to usage of certain radio resources.
2. The UE provides information to the gNB to allow that gNB can restrict radio resource usage to avoid the UE internal issue (or potential issue) caused by coexistence.

Q: Is there any clarification aspect that need to be described regarding the most basic assumptions on the scope of IDC. Are we on the same page? Shall the above (or similar) be included as a basic informative text?

Moderator: Understanding from last discussion that IDC can be WI (no SI needed) and the Leading Group is RAN2

Q2: Can comment on the above understanding of leading group and WI.

Feedback Form 1: General baseline Info

1 – Ericsson LM

First question: An important aspect, which we think should be captured regarding ”the most basic assumptions on the scope of IDC”, is that the IDC feature is only intended to address issues which the UE cannot solve by itself. So Bullet 1 above could perhaps rather say:

1. The UE detects internal issue or the possibility of internal issue caused by coexistence related to usage of certain radio resources, <u>which the UE cannot solve by itself</u>.

Second question: We think this can be a (small) RAN2 led WI.

2 – Xiaomi Communications

Q1: The two bullets are ok for us. And we are also Ok with Ericsson's updates.

Q2: Agree with the moderator's understanding. If most companies agree to address the MSD issue in the IDC item, RAN4 can be added as a secondary group.

3 – InterDigital

Q1: The two bullets are OK for us.

Q2: RAN4 can be added as the MSD issues can be addressed within IDC WI.

4 – Samsung Electronics Co.

Q1: The two bullets are okay with us, and Ericsson's update is also good.

Q2: It can be a small RAN2-led WI (without SI), or even it can be proceeded by TEI depending on the actual scope, as in Rel-16 for the introduction of NR IDC. That is, if MSD issue is not addressed based on RAN4 conclusion, and TDM is also excluded considering actual implementation, then to specify finer granularity of IDC indication for FDM solution would not require a separate WI. This can be further discussed after having input for the potential scope of the topic.

5 – HuaWei Technologies Co.

The two bullet are OK for us and we are fine with E's clarification as well. In general we prefer a small WI instead of TEI17, as this is easy for companies to track.

6 – China Unicom

All the two bullets and Ericsson's suggestion are ok for us, and we also prefer to have a small WI.

7 – TELECOM ITALIA S.p.A.

support Ericsson view. And it would be better to have the solution in TEI 17 (to provide a quicker solution to market requirements)

8 – Beijing OPPO Com. corp.

We agree with the current two bullets and Ericsson's comment.

9 – T-Mobile USA Inc.

We agree with the two bullets and Ericsson's comment. We also agree with Xiaomi and Interdigital that RAN4 can be added as a secondary group so that MSD issues can be addressed.

10 – Spreadtrum Communications

We agree with the current two bullets and Ericsson's comment. Also share some companies veiw that a small WI is enough.

11 – LG Electronics Inc.

We are ok with two bullets, but could be handled in TEI18.

12 – Sony Europe B.V.

Q1: The two bullets are OK for us.

Q2: RAN4 can be added as the MSD issues can be addressed within IDC WI.

13 – Lenovo (Beijing) Ltd

We are fine with above two bullets.

14 – vivo Mobile Communication Co.

Q1: We are OK with two bullets.

Q2: RAN2 should the leading WG for this WI.

15 – Nokia Corporation

Q1: We support the clarification from Ericsson.

Q2: If this happens, it should be RAN2-led (small) WI. We are also fine to add RAN4 as secondary group for the MSD objectives.

16 – China Mobile Com. Corporation

The two bullets are ok for us and we are also fine with Ericsson's updates.

We prefer to have a small WI. Whether to address the MSD issue is up to RAN4 and is discussing in RAN94e-R18Prep-22.

17 – BT plc

Q1: both bullets are agreeable for us and also fine with Ericsson's correction.

Q2: like TIM, our preference is a TEI17 rather than a small Rel-18 WI

18 – ZTE Corporation

We are okay with the two bullets with the Ericsson's update.

19 – Apple R&D

We agree with the two points summarized by moderator. We also agree that IDC can be a WID lead by RAN2.

20 – Facebook

We are fine with the two bullets and agree that this WI should be led by RAN2.

21 – Futurewei

Agree with the two bullets from the moderator plus the comment from Ericsson. Prefer a (small) WI led by RAN2.

22 – Qualcomm CDMA Technologies

We also agree with the two bullets from the moderator and Ericsson clarification on "which the UE cannot solve by itself.". Also support that this should be a WI led by RAN2.

23 – AT&T GNS Belgium SPRL

We agree with the two bullets from the moderator and Ericsson's comment. It should be a small WI led by RAN2. TEI approaches in the past have usually been difficult to track and have the tendency to consume more time than originally predicted. We also would like to see MSD addressed as expressed by a number of companies and add RAN4 as a secondary group.

24 – Intel Corporation (UK) Ltd

We are OK with the two assumptions and Ericsson's suggested text. We also think IDC can be handled as a small WI.

25 – Telstra Corporation Limited

Agree with Ericsson comments, TEI17 preferred

2.2 Inter-RAT interference FDM solutions

The interference between 3GPP and other RATs.

- *Enhanced FDM solution, which allows more flexible indication of affected frequencies (e.g. granularity of BWP or sub-band or PRB level). (RAN2)*

Moderator: It is the understanding of the moderator that this objective is not very controversial.

Q: Is this objective OK? Can we do even better: Is there a possibility to add more information (e.g. scenarios, requirements), or any other clue to guide the WG determine e.g. the granularity, or e.g. the temporal behavior. Maybe typical, prioritized or at least some example scenario can be listed (in the WID can be either in the objective or in justifications section).

Feedback Form 2: Inter-RAT interference FDM solutions

1 – Ericsson LM

Two detailed comments on the objective-bullet:

1) "more flexible indication" is not what this is about, it is rather about "more granular indication" (as also clarified by the parenthesis). Hence, we suggest changing to "more granular indication".

2) It is unclear to us the difference between "sub-band" and "PRB level". It seems to be two words for the same thing? To avoid confusion in the WGs we suggest removing "sub-band".

2 – Xiaomi Communications

We are ok with this objective. Ericsson's updates seem also ok to us.

3 – InterDigital

The objective is OK. Also, Ericsson's clarification seems correct.

4 – Samsung Electronics Co.

We are okay with the objective, and both suggestions from Ericsson look good to us.

5 – HuaWei Technologies Co.

we think this objective is OK with the modification to ”more granular indication”.

6 – Beijing OPPO Com. corp.

We are okay with the objective, but we think per BWP granular is enough, we can consider per sub-band or PRB level if it deems necessary in the later stage, so we suggest removing ”or sub-band or PRB level” in the current stage. In addition, Ericsson’s clarification is also acceptable to us.

7 – T-Mobile USA Inc.

We are OK with the objective and agree with the proposals from Ericsson.

8 – LG Electronics Inc.

We think this can be handled in TEI. The granularity level can be discussed based on company input to the RAN2.

9 – Spreadtrum Communications

We are ok with the objective. Ericsson’s clarification is good to us.

10 – Sony Europe B.V.

We are ok with the objective and think per BWP granularity could be the starting point

11 – Lenovo (Beijing) Ltd

we are fine with this objective.

12 – vivo Mobile Communication Co.

We are OK with the objective as well as the modification on ”more granular indication”.

13 – Nokia Corporation

We support the clarification from Ericsson: The intent seems to be more about allowing UE to indicate frequency-level granularity, not to allow ”flexibility” as such. Generally, we would be fine to investigate the use cases for this and align with existing LTE solutions.

14 – China Mobile Com. Corporation

We share some companies view with the objective and modification to “more granular indication”.

15 – BT plc

We support this objective. We are ok with Ericsson’s clarification.

16 – NEC Corporation We are OK with the objective for FDM solution, including suggestion from Ericsson, i.e. “more granular” indication.
17 – ZTE Corporation We are ok with this objective. Ericsson’s updates seem also ok to us.
18 – Apple R&D We support this objective.
19 – Facebook We support the objective.
20 – Futurewei OK with the objective, as modified by Ericsson.
21 – Qualcomm CDMA Technologies We support the objective. Since ”sub-band” is not defined clearly in the specifications, it is better to use only ”PRB level”.
22 – AT&T GNS Belgium SPRL We support the objective and the Ericsson suggestion.
23 – Intel Corporation (UK) Ltd We are OK with the objective with Ericsson’s suggestions (”more granular indication”, removing ”sub-band”).
24 – Telstra Corporation Limited We support the objectives and Ericssons proposed wording

2.3 Inter-RAT Interference TDM solutions

The interference between 3GPP and other RATs.

- *TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2)*

Note: MUSIM scheduling gap can be considered with TDM solution. LTE baseline can be considered.

Moderator: It is the understanding of the moderator that this objective can be acceptable but as indicated in the NOTE the relation with other mechanisms such as MUSIM Gaps or LTE baseline is not clear.

Q: Is this objective OK? Can we clarify the part of the NOTE applicable to TDM, or do we keep it as is? Can we do even better: Is there a possibility to add more information (e.g. scenarios, requirements). Maybe

typical, prioritized or at least some example scenario can be listed (in the WID can be either in the objective or in justifications section).

Feedback Form 3: Inter-RAT Interference TDM solutions

1 – Ericsson LM

Regarding the TDM solution. Of course one can argue that it has some benefits, at least on paper.

However, from a market point of view, we don't think the TDM solution is critical. Instead the FDM solution is addressing all use cases at least sufficiently well.

2 – Xiaomi Communications

We are ok with this objective. We think that the TDM solution is critical for improving the frequency efficiency, as the FDM solution would only cause the removal of the affected frequency(ies). If we only use the FDM solution, this may cause that some difficult band would only serve less number of UEs (which do not have any IDC issue). In many cases/deployments, it is difficult to find another candidate frequency when there is no overlapping frequency. TDM solution would allow the affected frequency to still be the serving frequency of the UE, when the UE is not under the coverage of another frequency.

3 – InterDigital

The TDM solution is complementary to FDM, as FDM may have some limitations. We are OK with this objective.

4 – Samsung Electronics Co.

We share the view with Ericsson that we do not see a strong need for the TDM solutions, considering the actual implementation from LTE time. That is, TDM solutions indeed require very strict coordination/consideration of non-3GPP RATs, but the issues can be easily addressed (even more efficiently) by utilizing FDM solutions in practice.

5 – HuaWei Technologies Co.

In general we think FDM enhancements could be more useful. If TDM solution is specified, as we discussed in RP-212289, we think the detailed solution can be left to WI phase discussion and there seems no much need to define a baseline solution when scoping the WI.

6 – China Telecommunications

We are OK with the TDM solution. We think the TDM solution can be complementary to the FDM solution as there are not always multiple bands existed in all scenarios or all places.

7 – TELECOM ITALIA S.p.A.

no strong view, but considering the controversial comments above, I suggest to first specify the FDM solution and if there is agreement to proceed with the TDM solution after completion of the first phase.

8 – TCL Communication Ltd.

We are OK with this objective which can be can complementary to the FDM solution.

9 – Beijing OPPO Com. corp.

We are OK with the TDM solutions, where it can be regarded as a complementary of the FDM solution.

10 – T-Mobile USA Inc.

We are OK with the TDM solution. TDM may also be useful for intra-RAT MSD issues, also.

11 – Spreadtrum Communications

We are OK with the objective and think the TDM solution is critical to resolve the IDC issue.

12 – LG Electronics Inc.

We think TDM solution is not needed. In any case, the final decision is up to network, and it is useless to spend WG time on discussing details of what needs to be provided in assistance information.

13 – Sony Europe B.V.

We are ok with the TDM solution as FDM solution may not work in all scenarios

14 – Lenovo (Beijing) Ltd

no strong view. We need to check if TDM solution is needed after FDM has be enhanced.

15 – vivo Mobile Communication Co.

We are OK with this bullet and the corresponding Note. Considering the LTE baseline could save some TU for this item.

16 – Nokia Corporation

Agree with Ericsson: TDM solution has never been deployed in LTE and is less important than FDM solution(s). If nobody implemented it for LTE, it's very unlikely they would do so for NR.

We think this part could be a second priority and focus should be on the FDM solution. We could also consider Rel-17 features (e.g. the MUSIM gaps) as potential solutions for this.

17 – China Mobile Com. Corporation

We are ok with this objective.

18 – China Unicom

We are OK with the TDM solution.

19 – BT plc

We support this objective.

20 – NEC Corporation

FDM solution may work in many scenarios, while TDM solution may be also useful in limited frequency support/availability case. We are fine to include the TDM and open for prioritization among solutions.

21 – ZTE Corporation

We see that this is useful.

As network vendor we would prefer if it is possible to have a common solution for this aspect with the solution developed for MUSIM gaps.

22 – Xiaomi Communications

Some information for those who think that the TDM solution should not be included in NR IDC as the LTE is not using it in practice:

- Due to the lack of TDM implementation at the network side in LTE, a widely implemented UE solution in LTE is to autonomously reduce the uplink transmission power via power backoff (i.e. UE-based TDM), which in practice causes lots of uplink transmission loss and reduced throughput in both LTE and other RATs (e.g. WiFi). We would consider that such situation as in LTE should be changed in NR for the benefits of both the operators and the UE vendors.
- In NR, we do have TDM solutions implemented in Rel-15 NR to resolve the internal interference issue in some difficult EN-DC band. In RAN2, we even have the "***singleUL-Transmission***" (i.e. TDM) UE capability defined to resolve the UE internal interference issue for certain band combinations.

23 – Apple R&D

Agree with Xiaomi that TDM solution is also critical.

24 – Facebook

We support that TDM solution is important and should be included as well.

25 – Futurewei

The TDM solutions are complementary to the FDM solutions. For now, an objective of providing an indication of a TDM pattern seems to be sufficient. Need further study to see if any legacy solution can be reused.

26 – Qualcomm CDMA Technologies

We support the TDM solution and it is an important part of IDC.

27 – AT&T GNS Belgium SPRL

We support the objective. We can also consider the TIM approach to phase the work in some way depending on the outcome.

28 – Intel Corporation (UK) Ltd

Our preference is to focus on FDM solution and consider TDM solution as second priority. Regarding MUSIM scheduling gap and LTE TDM solution, we prefer to reuse LTE TDM solution as much as possible assuming it is simpler to reuse LTE TDM solution because RAN2 has not worked on MUSIM gap details.

29 – Telstra Corporation Limited

Same as many others, prefer FDM, TDM can be included as a second priority

2.4 MSD related objective(s)

What about objectives related to excessive receiver sensitivity degradation?

Moderator: Last time this was not progressed, awaiting further conclusions from RAN4.

Q: is such objective still on the table? If yes, postpone? If yes, can it be described on a high level, e.g. to assess the tentative TU allocation needed for such objective in a IDC WI. If yes, how to concisely describe or refer to the scenario.

Feedback Form 4: MSD related objective(s)

1 – Ericsson LM Postpone
2 – Xiaomi Communications Yes, the objective is still on the table. The RAN4 discussion in the RAN#93e assumes that some study on MSD is required in RAN4. Then we could have a separate MSD study item in RAN4 or a study phase in RAN4 in the IDC WI. We are ok with either way. In the initial round discussion, we would like to list the MSD object as follows to collect company's preference. - To study and specify identified solution(s) to mitigate the interference amongst 3GPP frequencies due to the MSD issue in certain band combinations (e.g. NR band combination and EN-DC band combination). [RAN4, RAN2]
3 – InterDigital Yes. We believe that the MSD have to be addressed.
4 – Samsung Electronics Co. We assume it still requires the discussion in RAN4 as RAN concluded, so the issue can be postponed for now.
5 – HuaWei Technologies Co. Regarding MSD, we still prefer to discuss it separately. We understand RAN4 will discuss the package in March 2022 and thus all these RAN4-led aspects are better to be discussed at that time.
6 – TELECOM ITALIA S.p.A. agree with Huawei
7 – Beijing OPPO Com. corp. We think this issue can be postponed to wait for RAN4 conclusion.

8 – T-Mobile USA Inc.

The RAN4 MSD work hasn't made much progress, in large part because there are not clear objectives specified. We think it would be good to identify a study phase for the MSD issue within this IDC WI with clearly defined objectives, instead of continuing to study the MSD issue in RAN4 without clear goals and objectives.

9 – LG Electronics Inc.

Postpone

10 – Spreadtrum Communications

We can wait for RAN4 conclusion.

11 – Sony Europe B.V.

Yes, we think MSD can be discussed as part of IDC work and the objective could be led by RAN4.

12 – Lenovo (Beijing) Ltd

postpone and wait for RAN4 conclusion.

13 – vivo Mobile Communication Co.

Regarding MSD part, we think it should be left RAN4 discussion whether and how to define the corresponding capability. There is no need to include this part here.

14 – Nokia Corporation

While we that the MSD work is important, RAN4 is still working on that. we could state that once the RAN4 conclusion is clear, the MSD discussion can continue in Rel-18 if needed under the IDC umbrella (assuming the objective of the work is made clear, as also TMO commented).

15 – China Mobile Com. Corporation

This issue can be postponed.

16 – NEC Corporation

This issue can be postponed, i.e. not preclude it for now but need to wait for RAN4 WI/SI discussions

17 – ZTE Corporation

We also think this can be postponed to wait for RAN4 conclusions

18 – TELUS

We believe the MSD issue needs to be studied within this IDC WI as suggested by T-Mobile.

19 – Bell Mobility

We agree with TMO comment

20 – Apple R&D We are fine to postpone it. Just want to emphasize that the MSD issue in MUSIM scenario should be also considered.
21 – Facebook We are fine to wait for RAN4 conclusion
22 – Futurewei The MSD issues may depend on what RAN4 is doing in Rel-17. So, postpone.
23 – VODAFONE Group Plc We believe that this MSD topic is important. The TMO-US approach seems best with the Huawei approach as an alternative.
24 – AT&T GNS Belgium SPRL We agree with T-Mobile comment and should consider this objective given the lack of progress on the MSD issue in Rel-17. Ultimately, we can consider any RAN4 outcome in December when deciding the scope.
25 – Intel Corporation (UK) Ltd We prefer to postpone the objective and wait for RAN4's progress.
26 – Qualcomm CDMA Technologies MSD should be discussed separately from this WI. It is an ongoing discussion in RAN4 and seems to be controversial there while the other two objectives here are quite clear and simple. It is also not clear what RAN2 scope is for MSD.

2.5 Other

Other objectives or aspects

Feedback Form 5: Other

1 – Ericsson LM We assume this would be a rather small WI since we are basically copy (and massage) the LTE solution. In order to guide the WGs and streamline their efforts, we can add a general note as follows: NOTE: RAN2 should reuse the LTE solution as far as possible
2 – Xiaomi Communications The WI can focus on NR SA and certian MRDC scenarios including NR-DC and EN-DC. We can add a note as follows: NOTE: The specified solutions are expected to be applicable to various MR-DC architectures (including NR-DC and EN-DC).

3 – TELECOM ITALIA S.p.A. support both notes from Ericsson and Xiaomi
4 – LG Electronics Inc. We don't see the need to have a WI on IDC. The enhanced FDM solution (for finer granularity) can be handled in TEI.
5 – Nokia Corporation If we focus on the FDM solution (and possibly include MSD), a small WI can handle this. We do agree that the LTE solution should be baseline but it's likely better to have a real WI on this rather than put it under TEI.
6 – China Unicom We think it's better to have a separate WI to handle the above objectives.
7 – ZTE Corporation We agree that this should be a small WI with fairly focussed objectives.
8 – Apple R&D We are fine to have a note to cover MR-DC scenario.
9 – VODAFONE Group Plc Support both notes from Ericsson and Xiaomi.
10 – Qualcomm CDMA Technologies We agree that this should be a simple WI, taking LTE solution as baseline. In that regard, "Autonomous denial" can also be included in the objectives. This feature can be copied from LTE and will bring NR on par with LTE and can be useful for the scenarios where the UE does not need the whole TDM pattern to resolve the IDC problem.
11 – Intel Corporation (UK) Ltd We agree with Ericsson that RAN2 should reuse LTE solution as far as possible.

3 Intermediate Round

3.1 Previous Round Report

General

Moderator Report: The procedure as described seems to be supported including the addition by Ericsson.

Moderator suggestion:

IDC is assumed to work as follows:

1. *The UE detects internal issue or the possibility of internal issue caused by coexistence related to usage of certain radio resources, that the UE cannot resolve by itself.*
2. *The UE provides information to the gNB to allow that gNB can restrict radio resource usage to avoid the UE internal issue (or potential issue) caused by coexistence.*

Inter-RAT interference FDM solutions

Moderator Report: Not controversial. Followed the proposal by Ericsson which makes sense and had a lot of support.

Moderator suggestion:

- *Enhanced FDM solution, which allows more granular indication of affected frequencies (e.g. granularity of BWP or PRB level). (RAN2)*

Inter-RAT Interference TDM solutions

Moderator Report: A majority of companies (>2/3) support, some think it can be supported with lower priority. A handful companies think that given this was not supported in LTE and that it requires synch functionality etc. it shall not be supported. I.e. there is not yet consensus to have this objective, however on the other hand it is not clear that it shall be taken off the table now. Not much technical justification was given (so difficult to judge), mainly Xiaomi referring to a particular use case when this kind of solution can be useful. There were also comments whether this solution could align with other TDM solutions like MUSIM scheduling Gaps (open question). Futhermore there were only three companies providing feedback on whether LTE solution or MUSIM gaps should be considered baseline.

Moderator Suggestion: Keep the TDM solutions on the table (but with a TBD marker - there is absolutely not yet consensus), to allow for more consideration. Given the not so many comments can keep the Note as-is on LTE and MUSIM for now.

The interference between 3GPP and other RATs.

− TBD: TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2)

Note: MUSIM scheduling gap can be considered with TDM solution. LTE baseline can be considered.

MSD related Objectives

Moderator Report: Almost all companies think that this RAN4 discussion need to mature first and the corresponding objective for this WI shall be postponed.

Moderator suggestion: This is postponed (no further discussion needed). Expect that if there is anything to add to this WI for MSD, it will be added at latest March 2022 (when RAN4 contents of R18 is due).

Other

Moderator Report: The below proposals were made.

Proposal 1: RAN2 should reuse the LTE solution as far as possible.

Proposal 2: The specified solutions are expected to be applicable to various MR-DC architectures (including NR-DC and EN-DC).

Proposal 3: Include autonomous denial.

Proposal 4: This should be covered in TEI and not as a separate WI.

Moderator suggestion: Discuss further Proposals 1, 2, 3. RAN2 Chair (=moderator) prefers this to be a separate WI, so P4 can be discussed if important online at TSG RAN 94e.

3.2 General

IDC is assumed to work as follows:

1. *The UE detects internal issue or the possibility of internal issue caused by coexistence related to usage of certain radio resources, that the UE cannot resolve by itself.*
2. *The UE provides information to the gNB to allow that gNB can restrict radio resource usage to avoid the UE internal issue (or potential issue) caused by coexistence.*

Feedback Form 6: General

1 – Xiaomi Communications We are ok with the above two bullets.
2 – Beijing OPPO Com. corp. The above two bullets are ok for us
3 – Apple R&D We are fine with the two bullets.
4 – HuaWei Technologies Co. We are fine with the two bullets. Considering the IDC is to discuss the coexistence between 3GPP and other RAT, we suggest this can be mentioned somewhere in the above bullets.
5 – Ericsson LM Agree
6 – TELECOM ITALIA S.p.A. agree

7 – T-Mobile USA Inc.

Agree

8 – VODAFONE Group Plc

Agree

9 – ZTE Corporation

We are okay with the two bullets.

10 – Futurewei

Agree in general. It is rare to say the UEs allow or disallow the gNBs to do something. Suggest using the word "assist" instead. Also suggest the following editorial changes to improve the readability:

1. The UE detects internal issue ~~or the possibility of internal issue~~ caused or possibly caused by coexistence related to usage of certain radio resources, ~~that~~ which issue the UE cannot resolve by itself.

2. The UE provides information to the gNB to ~~allow that~~ assist the gNB ~~can~~ in restricting radio resource usage to avoid the UE internal issue (or potential issue) caused by coexistence.

11 – Facebook

We are fine with the two bullets.

12 – AT&T GNS Belgium SPRL

Agree.

13 – InterDigital

Agree with the two bullets.

14 – Nokia Germany

Agree with the proposed wording. The 2nd clarification from Futurewei on "assist" is fine with us.

15 – China Mobile Com. Corporation

We are ok with the above two bullets.

16 – Spreadtrum Communications

We are fine with the two bullets proposed by Moderator.

17 – MediaTek Inc.

Agree

18 – Lenovo (Beijing) Ltd

Agree

19 – Samsung Electronics Co. Agree
20 – Sony Europe B.V. We are ok with the two bullets
21 – Intel Corporation (UK) Ltd We are OK with the two bullets above.
22 – NEC Corporation We are fine with the above general bullets.
23 – vivo Mobile Communication Co. Agree.

3.3 Inter-Rat interference FDM and TDM solutions

The interference between 3GPP and other RATs:

- *Enhanced FDM solution, which allows more granular indication of affected frequencies (e.g. granularity of BWP or PRB level). (RAN2)*
- *TBD: TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2)*

  Note: MUSIM scheduling gap can be considered with TDM solution. LTE baseline can be considered.

Moderator: NO need to repeat comments from previous round, but for new insights please provide.

Feedback Form 7: Inter Rat FDM and TDM solutions

1 – Xiaomi Communications We think that the ”TBD” for TDM solution can be removed. For the inter-modulation interference, the TDM solution can be used to avoid the interference caused by the simultaneous uplink transmission of two uplink frequencies. For the interference caused by both the harmonic wave and the inter-modulation, the TDM solution can be also used to cover the deployment scenario when there is no extra overlapping frequency to the IDC-affected frequency.
2 – Beijing OPPO Com. corp. We share the same view with Xiaomi that TDM solution is also necessary.
3 – China Unicom We also agree with Xiaomi’s opinions that TDM solutions shall be considered in IDC in R18.

4 – Xiaomi Communications

After some discussion with operators, the TDM solution seems especially critical to resolve the inter-modulation inteference in the DC deployment (including both NR DC and EN-DC), as the DC requries the UE to have at least two uplink frequenices (i.e. one for MCG and one for SCG) configured. The TDM solution can be used to avoid the simultaneous uplink transmission in MCG and SCG.

5 – TCL Communication Ltd.

Harmonic ware and Inter-modulation interference do exist as Xiaomi mentioned, and TDM is necessary to aviod such interference.

6 – China Telecommunications

We support the TDM solution for supporting more IDC scenarios.

7 – Apple R&D

Inter-modulation and harmonic interference is a good justification for TDM solution. We also support to introduce the TDM solutions.

8 – HuaWei Technologies Co.

We are fine to support the TDM solution in Rel.18 IDC. However, we still would like to remove the note, i.e. not define the baseline solution, this can be left to WI phase with detailed solution discussion. Also this seems relevant to the discussion output from 3.4 P1.

9 – TELECOM ITALIA S.p.A.

inter-modulation inteference in the DC deployment is a critical scenario to be managed. Therefore ok to include TDM

10 – Ericsson LM

We do not think the TDM solution was a commercial success for LTE. And the use cases suggested above are the same as the use cases back in LTE-days (i.e. multi-carrier scenarios). Therefore we don't think it make sense to include the TDM solution.

However, unless other companies agrees with the above, we can be fine with having the TDM solution assuming it would not consume a lot of time in the WG to port the LTE-solution to NR. In order words, we would, in contrast to what Huawei suggest, want to take the LTE TDM solution as baseline so as to keep the scope limited. To create a new TDM-solution for NR does not seem like time well spent. (Again, the TDM solution was not a commercial success).

11 – VODAFONE Group Plc

We also support the inclusion of TDM solutions to manage harmonic and IM interference.

12 – ZTE Corporation

We support the FDM solution

For TDM solution we prefer to minimise the additional work needed and from this perspective, we think one option is to reuse the solution developed for MUSIM scheduling gap.

13 – Qualcomm CDMA Technologies

We also think TDM should be included. Note that this was part of LTE specifications. It is true that it wasn't a commercial success. However, that doesn't mean that the same will hold for NR.

14 – Futurewei

Agree with the FDM part. Support the view of keeping the TDM solutions as complementary to the FDM solutions.

15 – Facebook

We support keeping TDM solution as one of the scopes.

16 – AT&T GNS Belgium SPRL

OK with first bullet on FDM solution. For TDM solution, we propose the following edit and also agree to remove the TBD and to focus the scope of the work.

- *TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2)*

Note: LTE baseline can be considered.

17 – InterDigital

We support TDM solution as one of the scopes on the top of FDM.

18 – Nokia Germany

We still believe Samsung had a very good point about the technical hurdles of TDM solutions (*requiring very strict coordination/consideration* across RATs) and worry that RAN2 is going to specify something which has no practical use (as it did for LTE). If TDM still ends up in the scope, it should be of 2nd priority i.e. only once the work on FDM is complete, can the work on TDM start.

19 – China Mobile Com. Corporation

We also share the same view with Xiaomi that TDM solution can be considered in R18.

20 – Spreadtrum Communications

We share the same view with Xiaomi that TDM solution in R18 is necessary to manage harmonic and IM interference.

21 – LG Electronics Inc.

We think TDM solution is not needed considering the commercial use case.

Even if it is introduced, the impact should be minimized to avoid useless time spending in WGs. LTE solution should be used as a baseline, and limit the extra change for NR.

22 – MediaTek Inc.

We are also supportive on TDM solution. As commented by other companies, the FDM solution could not solve all the inter-modulation interference. However, we suggest to remove the Note on "*MUSIM scheduling gap can be considered with TDM solution.*". The purpose of MUSIM gap pattern is used to accommodate the paging/SI pattern of other SIM. We don't think TDM pattern for IDC will be the same for this.

23 – Lenovo (Beijing) Ltd

We are fine to have TDM solution.

24 – Sony Europe B.V.

There are scenarios where FDM solution is not always feasible. One additional scenario is for EN-DC involving problematic frequencies, LTE reference signals pollution may be avoided with TDM solution on NR side

25 – Samsung Electronics Co.

We are still not convinced to have TDM solutions in NR as indicated in the initial phase, and believe 3GPP should focus on the most feasible solution, instead of copying all the solutions from LTE. Note that we are not against to have the IDC as a separate WI, as indicated in subclause 3.4 below.

26 – Xiaomi Communications

I guess one reason that the TDM is not widely used in LTE is that the DC is not widely deployed in LTE stand-alone network, and DC is a critical IDC-affected scenario in NR NSA (i.e. EN-DC) and requires TDM solution to avoid inter-modulation interference.

27 – Intel Corporation (UK) Ltd

We're OK to consider TDM solution as second priority.

Regarding inter-modulation and harmonic interference, our understanding is that for MRDC and UL CA scenarios, FDM solutions are available (e.g. as reported in *affectedCarrierFreqCombInfoListMRDC* and *affectedCarrierFreqCombList-r16*). Solutions (FDM and potentially TDM) might be needed to solve potential inter-modulation and harmonic interference issue in NR-DC scenario.

28 – NEC Corporation

Enhanced FDM solution is fine. For TDM, we are OK to include with expecting similar to one supported in LTE or reuse MUSIM solution. Rather than putting TBD, prioritization can be done like other WI/SI discussions, i.e. TDM is second priority.

29 – vivo Mobile Communication Co.

We are OK with FDM with "more granular indication", and TDM with LTE solution as the baseline. Regarding IMD, we think for EN-DC, single UL tx was introduced in Rel-15, while for other scenarios, discussion is needed case by case, whether TDM solution or single UL tx solution is required. Besides, the interference outside 3GPP RAT in DC case need more discussion.

3.4 Other

Moderator Report: The below proposals were made.

Proposal 1: RAN2 should reuse the LTE solution as far as possible.

Proposal 2: The specified solutions are expected to be applicable to various MR-DC architectures (including NR-DC and EN-DC).

Proposal 3: Include autonomous denial.

Feedback Form 8: Other

1 – Xiaomi Communications We are ok with the above three proposals.
2 – Beijing OPPO Com. corp. Ok with the proposals
3 – Apple R&D We are fine with the three proposals.
4 – HuaWei Technologies Co. We are fine with P1 and P2, and also supportive to have the WI. Regarding P3, not sure why implemantion cannot solve this problem and better get clarification from the proponents first.
5 – Ericsson LM We only think P1 is needed. We assume that IDC can and need and should be only a very small Rel-18 item. And hence it should be reusing the LTE solution as baseline as far as possible.
6 – VODAFONE Group Plc We are fine with these proposals.
7 – ZTE Corporation We think Proposal 1 covers the intention of Proposals 2 and 3 since autonomous denial is already part of LTE baseline and FDM solution can be used for the DC scenarios highlighted in proposal 2.
8 – Qualcomm CDMA Technologies Support all three proposals. In general, we should take advantage of this Rel-18 IDC WI to adopt all LTE solutions for NR.
9 – Facebook Fine with the proposals.
10 – AT&T GNS Belgium SPRL OK with the three proposals.
11 – InterDigital We are OK with the 3 proposals.
12 – Nokia Germany Agree with Ericsson.

13 – LG Electronics Inc. Agree with Ericsson. Only P1 is needed.
14 – MediaTek Inc. We are fine with P1 and P2 but it is premature to say that RAN2 should support "*autonomous denial*" in NR. It can be considered and discussed according to P1. To our understanding, UE autonomous drop UL transmission granted by gNB may result in gNB confusion and worse network KPI. It requests more justification on why this kind of solution should be kept in NR, which could be discussed by WG if necessary.
15 – Lenovo (Beijing) Ltd We agree with the above three proposals.
16 – Sony Europe B.V. We are ok with above three proposals
17 – Samsung Electronics Co. First of all, regarding proposal 4, we are fine with the suggestion from RAN2 chair (=moderator) that the IDC item can be a separate WI (i.e. not as a TEI). Regarding proposals 1 to 3, we also share the view with many others that proposal 1 seems sufficient.
18 – China Mobile Com. Corporation We are fine with Proposal 1 and 2.
19 – Intel Corporation (UK) Ltd We're OK with Proposal 1 and 2.
20 – Xiaomi Communications According to the Rel-15 NR IDC, we have two FDM CRs, one for EN-DC (impacting 36.331 by introducing IDC-affected NR frequency in LTE RRC signaling) and one for NR SA (impacting 38.331 by introducing IDC-affected NR frequency in NR RRC signaling). Proposal 2 is also to align with the Rel-15 implementation, and to avoid the specification impact for NE-DC (which requires extra standard efforts of introducing IDC-affected LTE frequency in NR RRC signaling) .
21 – vivo Mobile Communication Co. We are OK with the proposals.

4 Final Round

4.1 Previous Round Report

General

Moderator Report: The following seems agreeable as background assumption. No Need to further discuss separately.

IDC is assumed to work as follows:

1. *The UE detects internal issue or the possibility of internal issue caused by coexistence related to usage of certain radio resources, that the UE cannot resolve by itself.*
2. *The UE provides information to the gNB to assist that the gNB may restrict radio resource usage to avoid the UE internal issue (or potential issue) caused by coexistence.*

Inter-RAT Interference FDM and TDM solutions and **Other**

Moderator Report 1:

- Other - 2: The following applicability statement is agreeable (no objections to its correctness): *The specified solutions are expected to be applicable to various MR-DC architectures (including NR-DC and EN-DC).*
- There has been no comments on the following line, which the moderator had misunderstood (sorry): *The Interference between 3GPP and other RATs.*

Moderator suggestion 1: Combine the texts above to one and make it general, e.g. to:

- *This WI expects to address the Interference between 3GPP and other RATs, as well as Inter-RAT and Intra-RAT interference in various MR-DC architectures (including NR-DC and EN-DC).*

Moderator Report 2: There were no further comments on the FDM solution objective and the following text seems agreeable:

- *Enhanced FDM solution, which allows more granular indication of affected frequencies (e.g. granularity of BWP or PRB level). (RAN2)*

Moderator Report 3:

- Wide support was expressed for the TDM solution and the use case given as justification, and the main counter argument was met by the explanation that a main use case of DC was not really deployed with LTE.
- Mentioning LTE as baseline seems acceptable, and this was also discussed in general under **Other**, and it seems well supported to make a general assumption for the whole WI that LTE can be the baseline.
- There was opposition to mentioning MUSIM Gap as baseline
- Mentioning Autonomous denial explicitly in the WID was not agreeable.

Moderator believe the following Objective and general note may be agreeable:

- *TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2).*
- *Note: LTE can be considered a baseline for the solutions developed in this WI.*

4.2 WID Justification

Moderator:

- It is proposed that the agreeable description from previous is added in the Justifications section, as a background.
- Other parts of the justification has only been partially discussed. I propose that the justification is discussed here by NWM during the final round

Proposal:

As a general assumption, IDC is assumed to work as follows:

1. *The UE detects internal issue or the possibility of internal issue caused by coexistence related to usage of certain radio resources, that the UE cannot resolve by itself.*
2. *The UE provides information to the gNB to assist that the gNB may restrict radio resource usage to avoid the UE internal issue (or potential issue) caused by coexistence.*

The current IDC solution in NR has the following limitations: It does not support well interference between 3GPP and Other RAT, as e.g. the interfered frequencies cannot be adequately indicated. Similar issue is present for some intra-3GPP scenarios. Introducing a TDM solution would make it possible to handle scenarios for which alternative non-interfered frequencies are not available. An important scenario for TDM is to address cases of inter-modulation interference in Dual Connectivity, where the UE has at least two uplink frequencies configured. The TDM solution may be used to avoid the simultaneous uplink transmission on the UL frequencies.

Feedback Form 9: Justification

1 – Xiaomi Communications

We think that the discussion on the intermediate round focuses on the inter-RAT interference between 3GPP and other RATs (e.g. WiFi). The DC scenarios raised by Xiaomi (and possibly others) in the intermediate round discussion actually refers to

the interference from 3GPP UL to other RATs (e.g. WiFi) DL, due to the UL inter-modulation between PCell and PSCell. Although we do have IDC interference for some intra-3GPP scenarios (e.g. 3GPP UL interferes the 3GPP DL), we think that the intra-3GPP scenarios could be discussed within the scope of the RAN4 MSD discussion, which actually handles the intra-3GPP interference and could be concluded in March, 2022. Thus we think that the following sentence can be removed.

~~*Similar issue is present for some intra-3GPP scenarios.*~~

2 – Nokia Germany

Agree with Xiaomi. The WI ought to address interference issues only between 3GPP and other RATs (e.g. WiFi). For interference issues within 3GPP, we can rely on RAN4 and/or existing mechanisms introduced for power sharing, overheating...

3 – Ericsson LM

Agree with the previous speakers: IDC is about interference between 3GPP and other RATs.

4 – HuaWei Technologies Co.

We share the same view as Xiaomi that the IDC focus on the inter-RAT interference between 3GPP and other RAT, and the DC scenarios discussed in the P2 of Other section refers to the interference from 3GPP UL to other RATs DL. So we also agree to remove the sentence "*Similar issue is present for some intra-3GPP scenarios*". In addition, we propose the following modification for clarity:

The TDM solution may be used to avoid the interference caused by simultaneous uplink transmission on the UL frequencies to Other RAT

5 – VODAFONE Group Plc

Agree with previous: IDC should focus on interference between 3GPP and other RATs. Proposal otherwise looks ok.

6 – Futurewei

We agree with companies on 1) that the DC scenarios were referring to the interference from the inter-modulation of 3GPP ULs to a non-3GPP RAT, not intra-3GPP interference; and 2) the suggestion to delete the sentence regarding intra-3GPP scenarios.

7 – Facebook

Agree with Xiaomi's comments.

8 – Samsung Electronics Co.

Agree with Xiaomi

9 – LG Electronics Inc.

First, we agree that IDC should focus on 3GPP and other RATs.

Secondly, the justification part should be justification for IDC item, not for TDM solution. TDM solution is one specific solution of IDC problem, and should not be addressed in the justification. Thus, we propose to remove all the concerned texts.

The current IDC solution in NR has the following limitations: It does not support well interference between 3GPP and Other RAT, as e.g. the interfered frequencies cannot be adequately indicated. ~~Similar issue is present for some intra-3GPP scenarios. Introducing a TDM solution would make it possible to handle scenarios for which alternative non-interfered frequencies are not available. An important scenario for TDM is to address cases of inter-modulation interference in Dual Connectivity, where the UE has at least two uplink frequencies configured. The TDM solution may be used to avoid the simultaneous uplink transmission on the UL frequencies.~~

10 – Xiaomi Communications

For LG's comments/modifications, I guess LG provided concerns on the commercial uses cases the previous two round discussion as follows: "We think TDM solution is not needed considering the commercial use case. "

The justification including the TDM commercial use cases provided by proponents including operators is a good clarification to address LG's (and others) concerns regarding the TDM commercial use cases.

11 – Qualcomm CDMA Technologies

We are fine with the Justification and also agree with Xiaomi regarding inter-RAT.

12 – Intel Corporation (UK) Ltd

Agree with Xiaomi's suggestion to remove intra-3GPP scenario.

Regarding "*the interfered frequencies cannot be adequately indicated*", there might be confusion that the intention is to indicate the victim frequencies of other RAT. Considering the potential objective of "to allow more granular indication of affected frequencies" refer to NR frequencies, we propose to change "*the **interfered** frequencies cannot be adequately indicated*" to "*the **affected NR** frequencies cannot be adequately indicated*".

We agree with Huawei's change regarding "*The TDM solution may be used to avoid the interference caused by simultaneous uplink transmission on the UL frequencies to other RAT*".

13 – Apple R&D

Seems this is common understanding among companies, then we can accept the proposal to limit it into inter-RAT.

14 – China Unicom

Agree with Xiaomi: IDC should focus on interference between 3GPP and other RATs.

15 – Spreadtrum Communications

We share the same view with Xiaomi and other companies that IDC should limit in inter-RATs.

16 – Lenovo (Beijing) Ltd

Agree with Xiaomi comments that IDC can address the interference between 3GPP and other RATs.

17 – NEC Corporation

We are fine with the proposals, except for "intra-3gpp" scenario. We also think it can be handled by RAN4 work other than IDC, if necessary.

18 – China Mobile Com. Corporation

We are fine with Xiaomi's comments and modification.

19 – vivo Mobile Communication Co.

1. We agree with others that IDC is target to address interference issues between 3GPP and other RATs (e.g. WiFi). Thus, we suggest to remove "intra-3GPP scenarios", make some change on: "The TDM solution may be used to avoid the interference from the simultaneous uplink transmission on the UL frequencies to other RATs."

2. Regarding IMD case, we would like to make more clarification: single UL tx was introduced in Rel-15 for IMD in EN-DC. Thus, whether using TDM solution or single UL tx to address IMD issue for other DC cases needs further discussed.

20 – MediaTek Inc.

Moderator: I will update the Justification according to comments and add an editors note that the contents of this section is preliminary. (to expect wordsmithing and checking at RP 94e if needed).

21 – ZTE Corporation

We agree with the justification and we also agree that the issue about interference between 3GPP and other RATs that the UE cannot mitigate by itself.

4.3 WID Objectives

It is proposed that minor wording polishing comments can be added as MS Word bubble comments in the Draft WID in the Drafts folders. More major comments are preferably provided here.

Objectives:

- *This WI expects to address Interference between 3GPP and other RATs, as well as Inter-RAT and Intra-RAT interference in various MR-DC architectures (including NR-DC and EN-DC).*
  - *Enhancements to FDM solution, to allow more granular indication of affected frequencies (e.g. granularity of BWP or PRB level). (RAN2)*
  - *Introduction of TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2).*

Note: LTE can be considered a baseline for the solutions developed in this WI.

Feedback Form 10: WID Objectives

1 – Xiaomi Communications

As also explained in Section 4.2 for the WID justification, the MR-DC scenario can focus on the inter-RAT interference between 3GPP and other RATs (e.g. WiFi) for now. The inter-RAT or intra-RAT interference within 3GPP for MRDC can be discussed/updated later after RAN4 achieves some consensus on the MSD in March 2022, which is supposed to handle various interference between 3GPP frequencies. Thus we propose to modify the first sentence of the objective as follows:

This WI expects to address Interference between 3GPP and other RATs (e.g. WiFi), ~~as well as Inter-RAT and Intra-RAT interference in~~ including various MR-DC architectures (~~including~~ i.e. NR-DC and EN-DC).

2 – Nokia Germany

We have 3 comments:

- Scope: focus on interference issues only between 3GPP and other RATs.
- TDM: should be listed as 2nd priority. We still strongly believe the TDM work will result in something that has no practical use and want to make sure that a well-working FDM solution is first agreed.
- LTE Baseline: perhaps it would be better to state that it ”should” be considered.

3 – Ericsson LM

As other say: IDC is for interference between 3GPP and other RATs (not intra-3GPP).

We think ”LTE **can** be considered as a baseline” should be changed to ”LTE **should** be considered as a baseline”. Of course LTE ”can” be considered as baseline, but the task of plenary is to frame the WI so it does not cause too much headache in the WGs. We think we are here trying to tell the WGs to actually consider LTE as baseline, not only that the WGs are allowed to so.

4 – Xiaomi Communications

It seems that according to the intermediate round discussion, many companies agree to have the TDM solution complementary to the FDM solution. To address Nokia’s concern, we can accept to have an extra NOTE as follows:

NOTE: The TDM solution is considered as complementary to the FDM solution.

5 – HuaWei Technologies Co.

We agree with Xiaomi’s comments and support their updates. Perhaps the reordering of the wording below can be more accurate.

This WI expects to address Interference between 3GPP (including various MR-DC architectures, i.e. NR-DC and NE-DC) and other RATs (e.g. WiFi).

We do not see need to further make TDM as second priority.

6 – T-Mobile USA Inc.

On the TDM approach, we asked a Wi-Fi/Bluetooth expert for their view and this is what they said:

The IDC TDM solution has two standardized components: 1) an In Device signaling interface, designed by BT SIG and 2) a UE – gNB signaling interface. Major UE vendors have implemented both for years. What actions does a eNB with regard to coexistence related problems is up to each eNB vendor. This part is not standardized, however the eNB has multiple ways in deciding how to schedule UEs with co-existence related issues in a more coexistence friendly manner. For example creating gaps in the UE transmissions. Also choosing specific LTE TDD frame types is important for the coexistence with BT.

So when we talk about a TDM solution, are we talkng about the in-device signaling interface or the gNB signalling interface or both? Maybe this should be clarified in the WID?

7 – VODAFONE Group Plc

We are ok with the objectives, but agree with the modification from Xiaomi to remove intra-RAT.

8 – InterDigital

We are Ok with the objectives, and support Xiaomi modification.

9 – Futurewei

We agree with companies on that IDC is for interference between 3GPP and other RATs, not intra-3GPP. Agree with Xiaomi's and Huawei's suggested changes on the main bullet (adopting either one is fine). In addition, the Note should apply only to the TDM solution (right now, it appears that the Note also applies to the FDM solution). Suggest to use a level-3 sub-bullet or indentation to make the Note appear as a part of the second sub-bullet.

10 – Facebook

We support the proposed modification from Xiaomi.

11 – Samsung Electronics Co.

We agree with all three comments from Nokia.

12 – Xiaomi Communications

Regarding T-mobile's questions, the "in Device signaling interface" is not reflected by the specification, but implied by the signaling reported by the UE. For example, when the UE reports its preferred DL transmission slots in NR, this means that other DL transmission slots in NR will have interference from other RATs (e.g. WiFi). In order to obtain the information of the interfered NR slot, the "in Device signaling interface" between the BT/WiFi module and the NR module would be needed. The WID does not need to explicitly state the "in Device signaling interface", as the "in Device signaling interface" is the internal UE implementation.

Then the standard work would focus on "a UE – gNB signaling interface". This have already been reflected by the current objectives, with some examples (e.g. "*indication of affected frequencies*" and "*indication of UE preferred TDM pattern*"). I guess we can clarify that the indication is from the UE, not from the network. Maybe we can update the objective as follows:

- *Enhancements to FDM solution, to allow more granular UE indication of affected frequencies (e.g. granularity of BWP or PRB level). (RAN2)*
- *Introduction of TDM solution (e.g. UE indication of ~~UE~~ preferred TDM pattern for UL/DL). (RAN2).*

13 – LG Electronics Inc.

We agree with all comments for Nokia. The TDM should be second priority, and LTE solution should be baseline for TDM solution.

14 – Qualcomm CDMA Technologies

We would have preferred to have autonomous denial which is another component of LTE IDC. We can accept the Moderator's proposal as a compromise since this is the last round. Also agree with Xiaomi that this should be for inter-RAT only. We don't understand why companies are trying to remove TDM (or making it second priority which is effectively the same thing as we all know). TDM is a useful feature and is supported in LTE as T-Mobile has commented. We are also fine with the suggestion that "LTE should be used as a baseline"

15 – Intel Corporation (UK) Ltd

Agree with the proposed objectives and Xiaomi's suggestion.

16 – Apple R&D

We agree with Xiaomi's modification.

17 – Spreadtrum Communications

Fine with Xiaomi's modification.

18 – Lenovo (Beijing) Ltd

Agree with xiaomi's modification.

19 – NEC Corporation

We think the WI should focus on inter-RAT in whole work of IDC, as some companies pointed out. For TDM, it can be simple as much as possible considering work load and thus LTE solution "should" be baseline (agree with Nokia).

20 – China Mobile Com. Corporation

We are fine with Xiaomi' modification.

21 – vivo Mobile Communication Co.

Considering IDC is used to address interference between 3GPP and other RATs, we agree Xiaomi's modification: "This WI expects to address Interference between 3GPP (including NR-DC and NE-DC) and other RATs (e.g. WiFi)."

22 – MediaTek Inc.

Moderator: These comments make things very clear, the wording referring to intra-3GPP interference will be removed and the wording *should* will be used for the note on LTE as a baseline. On the TMO comment: We can't really request a non-3GPP group to implement our results so the impact to a device internal interface specified outside 3GPP shouldn't be in a specific objective (at least not without very extensive pre-discussion), but we can send LS to inform wo any mentioning in the WID. There is now a breif description on what is the scope of IDC in the justifications section, and there will be affected specifications, impact in other group etc specified, so the applicability to 3GPP signaling seems to be clear without additional wording in objectives. On the priority of the TDM solution, I think there were no specific objections to Xiaomi's proposal to have a note with the wording *complementary* so I will use that.

23 – ZTE Corporation

We are okay with the FDM objective.

For the TDM objective, we would like to ensure that parallel discussions with similar solution outline is not developed independently between MUSIM work item and this work item. So, we propose to add one note as follows:

Note: The TDM solution should be designed in coordination with the solution defined in MUSIM

5 Report and Conclusions

Moderator Report:

- IDC is a WI and is led by RAN2
- The target use case is Interference between 3GPP and non-3GPP RAT.
- The scope to enhance the current FDM solution and add support for TDM solution is agreeable.
- LTE should be used as baseline.
- There were comments regarding the priority, ambition level of the TDM solution. It was finally captured with the objectives a note that TDM solution is complementary to the FDM solution.
- There were comments that the TDM solution need to consider the gap solution for MUSIM. There was no consensus to capture in the WID.
- There were comments to include Autonomous Denial. There was no consensus to capture in the WID.
- The MSD related potential WI objective was not discussed. RAN4 conclusions on MSD are needed to determine if applicable to this WI. Expectation that this could be considered when RAN4 contents of R18 is due (March 22).
- TU allocation was not discussed.

The following WID parts were agreeable:

Justification

Editors note: The Justification is preliminary.

As a general assumption, IDC is assumed to work as follows:

1. The UE detects internal issue or the possibility of internal issue caused by coexistence related to usage of certain radio resources, that the UE cannot resolve by itself.
2. The UE provides information to the gNB to assist that the gNB may restrict radio resource usage to avoid the UE internal issue (or potential issue) caused by coexistence.

The current IDC solution in NR has the following limitations: It does not support well interference between 3GPP and Other RAT, as e.g. the affected frequencies cannot be adequately indicated. Introducing a TDM solution would make it possible to handle scenarios for which alternative non-interfered frequencies are not available. An important scenario for TDM is to address cases of inter-modulation interference in Dual Connectivity, where the UE has at least two uplink frequencies configured. The TDM solution may be used to avoid the interference caused by simultaneous uplink transmission on the UL frequencies to Other RAT.

Objectives

This WI expects to address Interference between 3GPP (including various MR-DC architectures, i.e. NR-DC and EN-DC) and other RAT (e.g. WiFi).

- Enhancements to FDM solution, to allow more granular indication of affected frequencies (e.g. granularity of BWP or PRB level). (RAN2)
- Introduction of TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL). (RAN2).

  Note: The TDM solution is considered complementary to the FDM solution.

Note: LTE should be considered a baseline for the solutions developed in this WI.