3GPP TSG-RAN WG2 #120 Tdoc R2-22xxxxx

Electronic meeting, 2022-08-17 - 2022-08-29

Agenda Item: x.x.x.x

Source: Ericsson

Title: Report from [Post119-e][650][IDC] Comparison of FDM solutions (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This is the report from the following email discussion.

* [Post119-e][650][IDC] Comparison of FDM solutions (Ericsson)

      Scope: Analyse the details of FDM candidate solutions raised in R2-2208951, and compare solutions , e.g. applied scenarios (e.g. serving, non-serving, different MR-DC architecture), complexity (e.g. Unified for all scenarios or not), etc;

Intended outcome: Report to RAN2#120

Deadline:  Nov 3rd (Rapporteur may introduce intermediate deadlines, but no deadline during an inactive period, and no deadline in the period from Submisssion deadline to EOM of R2-119bis).

Please provide input by **31st October 23:59 UTC** to give time to compile the report.

Please take note of the guidance provided by the Chair:

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| Extra Long email discussions after R2-119-e, for R2-120, Deadline: Nov 3rd  Outcome tdocs for long email discussions shall be submitted to RAN2 120-e (Nov meeting). Please request tdoc numbers as for any other input tdoc to next meeting, i.e. by 3GU.  NOTE that these discussions shall consider the duration of R2 119bis-e to be an inactive period (in addition to the general 3GPP inactive periods). |

In RAN2-119e the following was agreed:

Agreements:

1 The Adjacent channel interference between NR Stand Alone (SA) or MN of NR-DC and non-3GPP should be considered for the FDM enhancement in Rel.18.

2 The Adjacent channel interference between SN (NR) of MR-DC and non-3GPP should be considered for the FDM enhancement in Rel.18.

3 NE-DC is not considered; We will work on NR freq as SA NR case.

4 We will not consider the enhancements on E-UTRA freq for EN-DC scenario.

FFS, on signalling details;

Agreements:

1 The IMD interference from simultaneous Tx in EN-DC to non-3GPP should be considered for the FDM enhancement in Rel.18.

2 The IMD interference from simultaneous Tx in NR-DC to non-3GPP should be considered for the FDM enhancement in Rel.18.

Note: the solution (on freq granularity) for adjacent can be reused for IMD, we will not invent new solution on freq granularity for IMD. FFS on signalling details.

Agreements:

1 Granular indications of the affected NR frequency reported for IDC issue needs to consider both serving and non-serving frequency as in the legacy FDM solution.

# 2 Contact information

Respondents to the email discussion are kindly asked to fill in the following table.

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| Company | Name | Email Address |
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# 3 Background

Current NR IDC FDM solution allows the network to configure a set of candidate frequencies of the granularity of ARFCNs:

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| OtherConfig-v1610 ::= SEQUENCE {  idc-AssistanceConfig-r16 SetupRelease {IDC-AssistanceConfig-r16} OPTIONAL, -- Need M  ...  }  IDC-AssistanceConfig-r16 ::= SEQUENCE {  candidateServingFreqListNR-r16 CandidateServingFreqListNR-r16 OPTIONAL, -- Need R  ...  }  CandidateServingFreqListNR-r16 ::= SEQUENCE (SIZE (1..maxFreqIDC-r16)) OF ARFCN-ValueNR |

If the UE experiences (or will experience) IDC issues that the UE cannot solve by itself on any of those candidate ARFCNs, the UE sends an IDC indication:

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| 1> if configured to provide IDC assistance information:  2> if the UE did not transmit a *UEAssistanceInformation* message with *idc-Assistance* since it was configured to provide IDC assistance information:  3> if on one or more frequencies included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself; or  3> if on one or more supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:  4> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide IDC assistance information;  2> else if the current IDC assistance information is different from the one indicated in the last transmission of the *UEAssistanceInformation* message:  3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide IDC assistance information;  NOTE 1: The term "IDC problems" refers to interference issues applicable across several subframes/slots where not necessarily all the subframes/slots are affected.  NOTE 2: For the frequencies on which a serving cell or serving cells is configured that is activated, IDC problems consist of interference issues that the UE cannot solve by itself, during either active data exchange or upcoming data activity which is expected in up to a few hundred milliseconds. For frequencies on which a SCell or SCells is configured that is deactivated, reporting IDC problems indicates an anticipation that the activation of the SCell or SCells would result in interference issues that the UE would not be able to solve by itself. For a non-serving frequency, reporting IDC problems indicates an anticipation that if the non-serving frequency or frequencies became a serving frequency or serving frequencies then this would result in interference issues that the UE would not be able to solve by itself. |

In this WI, RAN2 should increase the granularity from ARFCNs to something more granular. And the purpose of this discussion is to analyse and compare the candidate solution that were identified at RAN2#119. Such analysis should be done considering the applicable scenarios and should at least be in terms of complexity.

Solutions still in on the table (from [R2-2208951](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208951.zip)):

**Option 1**: Central frequency + Bandwidth of the actual affected frequency range (3/14 for both serving and non serving frequency, 2/14 non serving frequency) [5], [6], [9], [11].

**Option 2**: Starting frequency + Ending frequency of the actual affected frequency range (2/14 for both serving frequency and non-serving frequency) [5], [6].

**Option 2a**: starting frequency + Bandwidth of the actual affected frequency range (1/14 for both serving frequency and non-serving frequency) [6].

**Option 3**: BWP-based reporting using BWP ID (5/14 serving frequency only , 2/14 for both serving and non serving frequency) [1], [6], [7], [10], [12], [13].

**Option 4**: BWP-based reporting using BWP ID + PRB index (2/14 for serving frequency) [6]. [7], [9].

**Option 5**: Measurement object ID [5] (1/14 – For LTE frequency only)

**Option 6**: Resource Block Group (RBG) based reporting (1/14 for both serving frequency and non-serving frequency) [8].

# 4 Discussion

Some companies discussed in their papers whether the enhancement should work also for non-serving frequencies (i.e. frequency resources which the UE is currently not using). First, the rapporteur suggests getting a common understanding whether the enhanced FDM-granularity should work both on serving and non-serving frequencies.

**Q1: Is it a requirement that RAN2 must define solution(s) for both serving and non-serving frequencies?**

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| **Company** | **Yes/No** | **Comments** |
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Some solutions proposed in RAN2#119 had one type of indication for serving frequencies and another type of indication for non-serving frequencies. The rapporteur assumes that having different indications for serving and non-serving frequencies come with at least some added complexity, and it needs to be understood if that added complexity is justified by additional benefits. The rapporteur invites companies to indicate if there would be any benefits or needs of such an approach and explain those benefits/needs.

**Q2: Is there any technical benefit or need of having different FDM indications for serving vs. non-serving frequencies? If so, what?**

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| **Company** | **Yes/No** | **Comments** |
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Option 5 is “Measurement object ID” and is described in [5]. The proponent of this solution clarified that this solution is for LTE frequencies only. In the LTE IDC solution the UE indicates IDC problems to the network by referring to the measurement object IDs:

InDeviceCoexIndication-r11-IEs ::= SEQUENCE {

affectedCarrierFreqList-r11 AffectedCarrierFreqList-r11 OPTIONAL,

tdm-AssistanceInfo-r11 TDM-AssistanceInfo-r11 OPTIONAL,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension InDeviceCoexIndication-v11d0-IEs OPTIONAL

}

AffectedCarrierFreqList-r11 ::= SEQUENCE (SIZE (1..maxFreqIDC-r11)) OF AffectedCarrierFreq-r11

AffectedCarrierFreq-r11 ::= SEQUENCE {

carrierFreq-r11 MeasObjectId,

interferenceDirection-r11 ENUMERATED {eutra, other, both, spare}

}

The rapporteur’s understanding of the proposed Option 5 is not that it is an alternative to Option 1/2/2a/3/4/6, but rather a proposal to stick to the current way of indicating problematic frequencies in LTE, i.e. to still use measurement object IDs.

**Q3: Do you agree to that, for LTE, problematic frequencies are indicated by indicating measurement object IDs?**

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| **Company** | **Yes/No** | **Comments** |
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Option 1, 2 and 2a are in the rapporteur’s point of view the same, with the difference of how the final stage-3 ASN.1 signalling would be defined. For the sake of this analysis, the rapporteur suggests treating them as one group of solutions.

**Q4: What are technical benefits and drawbacks of a solution where the UE indicates a frequency region (e.g. like 1/2/2a):**

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| **Company** | **Benefits** | **Drawbacks** |
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Option 3 is:

**Option 3**: BWP-based reporting using BWP ID (5/14 serving frequency only , 2/14 for both serving and non serving frequency) [1], [6], [7], [10], [12], [13].

**Q5: What are technical benefits and drawbacks of solution 3:**

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| **Company** | **Benefits** | **Drawbacks** |
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Option 4 is:

**Option 4**: BWP-based reporting using BWP ID + PRB index (2/14 for serving frequency) [6]. [7], [9].

**Q6: What are technical benefits and drawbacks of solution 4:**

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| **Company** | **Benefits** | **Drawbacks** |
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Option 6 is:

**Option 6**: Resource Block Group (RBG) based reporting (1/14 for both serving frequency and non-serving frequency) [8].

**Q7: What are technical benefits and drawbacks of solution 6:**

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| **Company** | **Benefits** | **Drawbacks** |
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If companies have any other relevant comments, please fill them in here:

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| **Company** | **Comment** |
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# 3 Conclusion

In the previous sections we made the following observations:

[Observation 1 An Observation with automatic numbering. Assign this type by pressing Alt-O. A list of all Observations can be found in the Conclusion section.](#_Toc509923396)

Based on the discussion in the previous sections we propose the following:

[Proposal 1 A Proposal with automatic numbering. Assign this type by pressing Alt-P. A list of all Proposals can be found in the Conclusion section.](#_Toc509923397)

# 4. References

1. [R2-2207162](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207162.zip) Consideration on the FDM enhancement ZTE Corporation, Sanechips
2. [R2-2207469](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207469.zip) Discussion on FDM solution enhancements for IDC OPPO
3. [R2-2207539](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207539.zip) Discussion on FDM solution enhancements Sharp
4. [R2-2207556](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207556.zip) Assistance information for FDM Nokia, Nokia Shanghai Bell
5. [R2-2207804](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207804.zip) Discussion on the IDC FDM solutions Xiaomi
6. [R2-2207844](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207844.zip) Discussion on FDM solution for in-device co-existence interference avoidance Samsung
7. [R2-2207936](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207936.zip) Discussion on FDM solution in IDC Apple
8. [R2-2207968](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207968.zip) Enhanced FDM solution for IDC Intel Corporation
9. [R2-2208116](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208116.zip) FDM Solutions in IDC Qualcomm Incorporated
10. [R2-2208135](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208135.zip) FDM solution for IDC Ericsson
11. [R2-2208230](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208230.zip) Discussion on FDM enhancement Huawei, HiSilicon
12. [R2-2208396](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208396.zip) Discussion on FDM solution for R18 IDC vivo
13. [R2-2208524](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208524.zip) IDC FDM solution LG Electronics
14. [R2-2207161](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2207161.zip) Clarification on the IDC scope ZTE Corporation, Sanechips

1. [R2-2208951](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208951.zip) [AT119-e][651][IDC] FDM solution enhancements (Huawei) Huawei, HiSilicon