**3GPP TSG-RAN WG2 Meeting #121 R2-230XXXX**

**Athens , Greece, 27th Feb- 3rd Mar, 2023**

**Agenda item: 8.10.2**

**Source: Huawei, HiSilicon**

**Title: [AT121][652][IDC] Discussion on FDM solution(Huawei)**

**Document for:**  **Discussion**

# 1. Introduction

This paper is to trigger the following email discussion of IDC FDM solutions:

* [AT121][652][IDC] Discussion on FDM solution(Huawei)

      Scope: Leftover issues indicated in the Note; TP for ASN.1 and procedure parts.

Additional open issue on whether LTE MN can configure R18 NR IDC for NR side.

Intended outcome: Report to Friday CB session in R2-2302071

Deadline: Thursday 2023-03-02 19:00 EET

## 1.1 Contacts

Contact person for each participating company:

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Xiaomi | Yumin Wu | wuyumin@xiaomi.com |
| Ericsson | Min Wang | min.w.wang@ericsson.com |
| Intel | Yujian Zhang | yujian.zhang@intel.com |
| Qualcomm | Sherif ElAzzouni | selazzou@qti.qualcomm.com |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# 2. Discussion

During the online discussion in the IDC session today there were some open points that were identified for the proposals in [Post120][652][IDC] which needed further confirmation/ discussion. This email discussion seeks further company views for these open points.

**Open Point 1– Whether gNB should configure the candidate frequency ranges using (centre frequency + bandwidth) for which the UE should report IDC issues**

During the discussion different view were expressed, some companies expressed the view that a reasonable gNB implementation has good knowledge of the frequency range where the IDC problem could occur and such configuration from the network will result in controlling the reporting from the network and also power saving as the UE does not have check for the IDC issue over the entire carrier frequencies, while the other companies thought gNB has no idea about where such IDC issues could happen and the reporting could be left to UE implementation.

**It is assumed by the rapporteur that a reasonable gNB will configure candidate serving frequencies in the region which is close/ adjacent to channels used by the other non- 3GPP technologies on which it will apply scheduling restrictions to resolve the IDC problems**.

If such configuration is not provided by the gNB, there can be following potential issues which can arise

1. There will be no way for the network to control reporting from the UE.
2. UE will be unsure if it should report actually affected frequency range that is far away from the NR carrier centre frequency as shown in figure below as there is no guidance from the network. Some UE implementation will send the reports while others may decide not to.

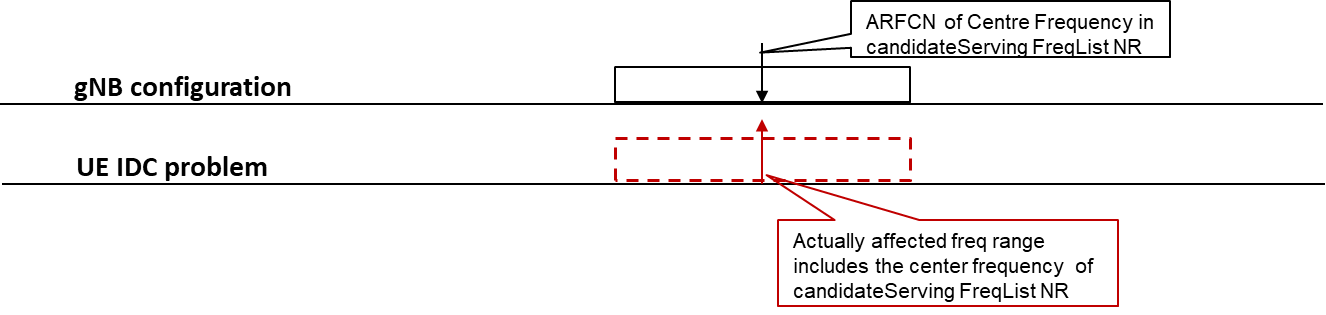


Figure 1 – Case 1 - the affected frequency range includes the centre frequency

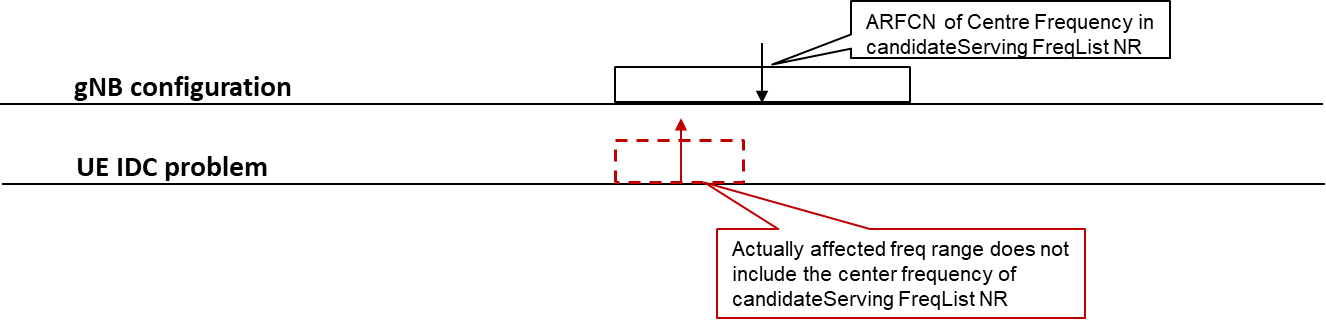


Figure 1 – Case 2 - the affected frequency range does not include the centre frequency

1. If the gNB implementation/configuration is such that it addresses IDC issues only if it receives the report that fall within certain preconfigured frequency ranges, many of the reports from the UE covering entire carrier frequency will be discarded silently by the gNB without taking any action.

All these issues will cause excessive signalling and waste of air interface resources.

Question 1 – To prevent such issues from happening, do companies agree that it is beneficial for the network/gNB to configure the candidate frequency ranges using (centre frequency + bandwidth) for which the UE should report IDC issues.

**Proposal x: The gNB configures the candidate frequency ranges using (centre frequency + bandwidth) for which the UE should report IDC issues.**

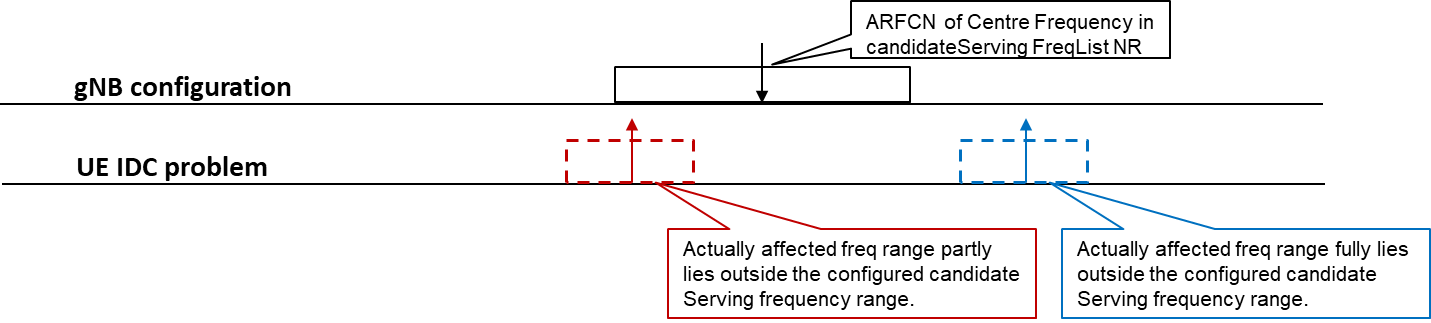
|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **Comments** |
| Xiaomi | Yes | Firstly, we consider that configuring the bandwidth seems a reasonable way for the network to restrict the UE reporting signaling, e.g. avoiding the reporting of affected frequency range which is not to be configured. According to the experience we had since LTE, the band which is potentially to be affected is known by the gNB and the UE, as the expected interference is restricted by the modulation (e.g. harmonic wave or inter-modulation wave) of each band. The only thing which is unknown to the gNB is that the exact frequency range affected could be different for different UEs depending on the UE implementation (e.g. RF isolation level). Secondly, we think that the central frequency of the affected frequency range in many cases may not be the central frequency as configured by the network. For example, the harmonic interference can happen for adjacent frequency bands, the interference frequency range can start from the lower bound of the frequency range configured by the network, and can increase when the isolation level of the UE implementation decreases. Then the central affected frequency for different UEs can be different for the same band. This means that the central frequency of the reported frequency range does not need to be the same as the central frequency provided by the network.  Thus, once the reported frequency range (i.e. frequency+bandwidth) is within the frequency range as configured by the network, we think that the understanding on the actually affected frequency range can be aliged between the UE and the gNB. |
| Ericsson | yes | The gNB has full knowledge on the system based on UEs’ inputs/reports. Especially there may be multiple UEs trigger IDC issues and report to the gNB, based on which the gNB has good understanding on regions where IDC issues may be detected. In this way, the gNB can guide UEs to detect IDC issues. This would be bebeficial to reduce unnecessary IDC detection and report. |
| Intel | Yes |  |
| Qualcomm | Depends on Q3 | In general, as we mentioned before, this issue suffers from three drawbacks:   1. NW has no idea how the UE measures IDC issues or its filtering capability or granularity. This means that NW can effectively configure a BW that is too small for the UE to measure and take additional actions that don’t solve UE problems 2. Ambiguity: If IDC issue has 25%,50%,75% overlap with the configured BW, both UE reporting and not reporting does not add any useful information, thus there would be misalignment between NW and UE implementation if it reports ot not report 3. The solution the NW implements may not solve UE problem   Thus without ensuring that UE implementation can send reports partially overlapping with the configured BW we cannot agree to this approach. |
| ZTE | No | With legacy method (only centre frequency), the UE would determine bandwidth for each centery frequency based on its own capability, then the UE can determine the frequency range based on the century frequency and its supported bandwidth, we think it can also work for R18.  Then the key difference is about which node determine the bandwidth, UE or network.  Our main concern on the network configuration/determination with bandwidth is as below:  (1)Introducing bandwidth in the configuration may have impact to the MN SN coordination, for example, for the MR-DC IMD reporting ,the SN may need to indicate bandwidth info to the MN  (2)Furthermore, we also need to confirm with RAN3 whether it would have the impact to the CU-DU interface, for example, which node can determine the bandwidth, CU or DU.However, RAN3 is not involved in this WID.  (3)It would increase the difficulty of the Bandwidth value definition especially for the case that only very small IDC affected part is located in the configured frequency range.  Take the below figure as an example, we assume:  The UE supported bandwidth is100M but the network only configure 80M as the bandwidth.    Then if the affected range is highlighted as Red below, there is only 1Mhz (mach narrower than the minimum granularity of bandwidth e.g. 5Mhz as shown in Question 2) included in the configured frequency range, it would be hard (or even impossible) for the UE to report the actual affected frequency range for that the affected part (that included in the configured frequency range) is quite narrower than the the minimum granularity of bandwidth.  For such case, with the legacy method, the UE would determine the frequency range as in the above figure (f1+100M) and then it would be easier for the UE to report the centry frequency and bandwidth.(e.g. f2+10M) |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Question 2 – If the answer to Question 1 is “yes” Do you agree that ASN.1 framework and field description for gNB configuration around which UE is requested to report IDC issues for FDM solution enhancements can be considered as the starting point in the Text proposal. The Bandwidth values can be fine-tuned further and the procedure text can be written after these are agreed.

**Proposal x: The ASN.1 framework and field description is used for the CR drafting.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **Comments** |
| Xiaomi | Yes | We think that the text proposals provided by the rapporteur can be the baseline for the RRC CR drafting. Some details can be polished via post-meeting email discussion. The values for bandwidth {mhz5, mhz10, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz200, mhz300, mhz400} can be taken as the baseline, and other values can be discussed based on contributions. The ASN.1 structure for IMD issue is added in the text proposal. |
| Ericsson | Yes with comments | Regarding the bandwidth values, the discussions can be carried out together with the discussions on IDC report. |
| Intel | Yes |  |
| Qualcomm | Yes | Fine as a baseline with usual caveats that more values or details can be added later |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

During the discussion some companies also expressed the view that UE should be allowed to report the actual affected frequency ranges that may either partly of fully lie outside the range configured by gNB as shown in figure below.



**One thing to note is that even though the UE reports the affected frequency ranges outside the gNB’s configured ranges, gNB may not take any actions on the frequency ranges that lie outside its configured ranges.**

Question 3 –Do companies agree that the UE does not follow the network instructions and the UE should be allowed to report the frequency range where a part of or whole of the actual affected range is outside the frequency range configured by the gNB?

If the answer is “yes” the proponent companies are requested to provide the what will be the benefits of deviating from the legacy principles of the network providing the configuration and the UE following it.

**Proposal x: The frequency range (centre frequency + bandwidth) reported by the UE is within the frequency range (centre frequency + bandwidth) configured by the network.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **If the answer is “yes” please provide the what will be the benefits of the UE providing such reports to the network.** |
| Xiaomi | No | Same comments as given for Question 1 |
| Ericsson | No |  |
| Intel | No | The general principle is that UE follows gNB configuration. We don’t see the motivation that UE reports frequency range which is not within gNB configuration, as such information will not be used by gNB anyway. |
| Qualcomm | Yes | Having the UE strictly report within the range does not make sense for te following issue:  , this issue suffers from three drawbacks:   1. Ambiguity: If IDC issue has 25%,50%,75% overlap with the configured BW, both UE reporting and not reporting does not add any useful information, thus there would be misalignment between NW and UE implementation if it reports ot not report 2. The solution the NW implements may not solve UE problem 3. Requires NW to guess both IDC issues and UE filtering capability.   Thus to agree for any reporting BW configuration, the UE cannot prohibited from reporting the actual IDC issue that is happening. Otherwise the configuration would have no guarantees to solve the IDC issue. |
| ZTE | See comments | We agree with the general principle that UE follows gNB configuration.  However, as commented in the Question 1, if the network include the bandwidth in the configuration, it would be hard (or even impossible) to define the bandwidth values to satisfy the requirement as in the proposal x, especially for the case that the affected part (that included in the configured frequency range) is quite narrower than the the minimum granularity of bandwidth. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

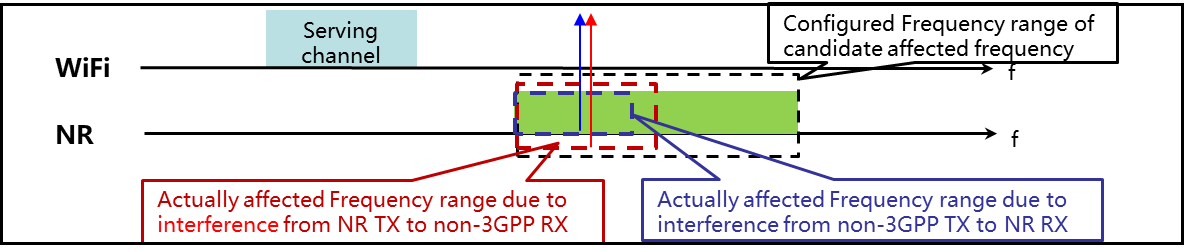
**Open Point 2– Confirm the usage of direction of inference IE in the enhanced FDM solution**

We have agreed to add the direction of interference for the reporting for the agreed Option 1. The direction of interference shall serve the same purpose as in the existing FDM solution as described in the field description below

***interferenceDirection***

Indicates the direction of IDC interference. Value *nr* indicates that only NR is victim of IDC interference, value *other* indicates that only another radio is victim of IDC interference and value *both* indicates that both NR and another radio are victims of IDC interference. The other radio refers to either the ISM radio or GNSS (see TR 36.816 [44]).

Considering that the actually affected frequency range for the interference from NR TX to non-3GPP RX and the interference from non-3GPP TX to NR RX could be different as shown in Figure below. The UE can include two entries in a report with different interference direction if the actual affected frequency regions in red and blue colour for option 1 is different. If they are the same, UE can include one entry for the frequency range with the interference direction set to “both”.



The example of such entries for the enhanced FDM solution is given below .

AffectedCarrierFreqRange 1 : {

centerFreq : Centre freq for Red region;

affectedBandwidth : BW of Red region;

interferencedirection: Other;

}

AffectedCarrierFreqRange 2 : {

centerFreq : Centre freq for Blue region;

affectedBandwidth : : BW of Blue region;

interferencedirection: NR;

}

Such a report from the UE will provide precise information to the gNB for addressing the IDC issue in UL and DL direction.

Question 4 –Can companies confirm that for one candidate frequency range indicated by the gNB, if the UE detects interference in both directions, the UE can report two affected frequency ranges with the respective interference direction ?

**Proposal: If the UE detects interference in both directions, the UE can report two affected frequency ranges with the respective interference direction, as legacy.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **Comments** |
| Xiaomi | Yes, but | We think that this should be allowed by the procedural texts by default. It seems that no extra UE behaviours need to be defined. Once we have a draft running CR, we can double-check whether additional clarification is needed. |
| Ericsson | Yes with comments | We understand the intention. Our understanding for the proposal is that, the proposal doesn’t result in **additional spec change/ASN.1 change** compared to the case where the UE only needs to report one frequency region with the interference direction (both). If companies have common understanding on this, we will be fine to the proposal. |
| Intel | Yes | Agree with others that this behavior should be allowd by procedure text. |
| Qualcomm | Yes | Which reports the UE include is based on UE implementation as per current understanding |
| ZTE | Yes |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Open Point 3– Further discuss whether the inter node co-ordination for IDC solutions to address the IMD issue where combination of frequencies involving MN and SN are affected is needed**

During the online discussions we could not discuss whether the inter node co-ordination for IDC solutions to address the IMD issue where combination of frequencies involving MN and SN are affected is needed due to limited time. Hence the companies are encouraged to provide further views on these through the following questions

Question 5 –Do you think whether the inter node co-ordination between MN and SN for IDC solutions to address the IMD issue where combination of frequencies involving MN and SN are affected is needed? If it is needed what would be the reason for having such coordination?

**Proposal x: No extra inter node co-ordination between MN and SN for IDC solutions to address the IMD issue is needed.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **Comments** |
| Xiaomi | Maybe No | If the MN takes the control of all frequencies to be configured, which is currently already possible, it seems that no further coordination between MN and SN is needed.  It seems not reasonable that the SN configures some MCG frequency for the reporting of the IMD issue, as the SN is anyway not able to control the MCG frequency. If the SN only configures the SCG frequency for IMD issue, it seems that the coordination between MN and SN is also not needed. |
| Ericsson | No | As indicated in our paper [R2-2300523](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/Docs/R2-2300523.zip), IMD issue may be detected by UE in the below cases  Case 1: IMD issue between simultaneous TX of carriers in MCG and non-3GPP  Case 2: IMD issue between simultaneous TX of carriers in SCG and non-3GPP  Case 3: IMD issue between simultaneous TX of MCG carriers and SCG carriers, and non-3GPP  For Case 1 and Case 2, the proposal 1 and the proposal 2 are still valid. UE can just report IDC issues for combination of carriers in MCG or in SCG using existing signalling of combinations of candidates. There is no coordination needed between MN and SN.  For case 3, there is no coordination needed either. In this case, it is sufficient to leave up to UE implementation to only report the affected MN candidate frequencies to MN or affected SN candidate carriers to the SN. For the former, MN would deactivate the affected carriers in MCG, For the latter, SN would deactivate the affected carriers in SCG. If the UE decides to send the IDC indication to the MN, the MN would de-configure/similar the MN-frequencies which are part of causing the IMD issues, and if the UE decides to send the IDC indication to the SN, the SN would de-configure/similar the SN-frequencies which are part of causing the IMD issues. An alternative to this would be for the UE to indicate a combination of MN candidate frequencies and SN candidate frequencies to the MN and/or SN and the MN and SN would coordinate to decide if the MN should address the IMD issues by de-configuring/similar the MN carriers, or whether the SN should address the IMD issues. However, we believe that it is sufficient to leave it to the UE implementation to send the IDC indication to either the MN or the SN, and hence we can avoid additional work of specifying coordination between nodes. Therefore, it would be beneficial to avoid further coordination between MN and SN even for IMD issue. Thus, we can have a unified framework for both FDM solutions and TDM solutions.  Therefore, we make the below proposal   1. Upon detecting IMD issue for carriers across MCG and SCG, it is up to UE implementation to determine to report only the affected frequencies and bandwidth in the MCG to the MN or affected frequencies and bandwidth in SCG to the SN.   In addition, the UE can also include **the TDM information** in the UAI report. Based on the UE reported affected frequencies and bandwidth in a CG (just one CG) and the TDM information, the gNB can decide whether to **deactivate the affected frequeicies and bandwidth**, or apply a **TDM solution** to address the IMD issue affecting carriers cross CGs.. |
| Intel | No extra coordination | Although the coordination of IDC solution between MN and SN might be helpful to further optimize resource utilization, it requires additional standardization efforts. Considering that enhanced FDM solution already improves resource utilization with finer granularity indication, we don’t need to consider inter-node coordination for IDC solution to address IMD issue. |
| Qualcomm | Likely no for EN-DC. No strong opinion for NR-DC | Coordination can be used to optimize solving the IMD issue but may not be strictly necessary |
| ZTE | Yes | We think for the IMD interference between MN and SN, the SN shall know (from the MN) which frequency ranges would be used by the MN side to further determine the available frequency ranges at the SN side, otherwise it will lose the meaning for the UE to report MR-DC IMD interference with dedicated frequency ranges.  For example  MN: F1: Frequency Range1, Frequency Range2 SN: F2: Frequency Range1, Frequency Range2  IMD 1: F1 Frequency Range1+ F2 Frequency Range1 IMD 2: F1 Frequency Range2 + F2 Frequency Range2    If the MN indicates the SN that F1 was selected (e.g. in the selectedBandEntriesMNList), but doesn’t indicate the Frequency Range based information to the SN, the SN would take all frequency ranges on the F2 as invalid, then ,it will lose the meaning for the UE to report MR-DC IMD interference with dedicated frequency ranges. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Question 6 – if the answer to the above question is yes, please provide summary/key points of information to be exchanged between MN and SN?

|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **Comments** |
| Qualcomm |  | If coordination is needed, IDC reports can be shared |
| ZTE | Yes | The SN shall know (from the MN) which frequency ranges would be used by the MN side to further determine the available frequency ranges at the SN side. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Open Point 4– Any additional coordination is needed between MN and SN for applying TDM solution to resolve the problem when network receives the reporting from UE.**

During the online discussion for TDM solution it was agreed that Per CG pattern is supported for MR-DC. SN can configure the UE to report the TDM assistance information directly to SN, either through SRB 1 (if SRB3 is not configured) or SRB 3. However, there is one open issue whether any additional coordination is needed for network to resolve the problem when network receives the reporting from UE including TDM assistance information. Company views on this is invited

Question 7 – Do you think whether any additional coordination is needed between MN and SN for applying TDM solution to resolve the problem when network receives the reporting from UE that includes TDM assistance information?

**Proposal x: No extra coordination is needed between MN and SN for applying TDM solution.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **Comments** |
| Xiaomi | Maybe No | For harmonic inteferecne, MN can require the report of affected MCG frequency and the TDM assistance information for MCG, and SN can require the report of affected SCG frequency and the TDM assistance information for SCG. It seems no coordination is needed.  For IMD interference between MCG and SCG, it seems only reasonable for the MN to configure the reporting of the affected MCG frequency and the SCG frequency and the TDM assistance information, as the SN is not able to control the MCG frequency. Since the IMD interference only happens when simultaneous transmissions happen at both the MCG and SCG, configuring the TDM pattern at the MCG seems already able to resolve the IMD issue between MCG and SCG. |
| Ericsson | No | We prefer to have an unified framework for both FDM and TDM where no (further)coordination is needed apart from the existing mechanism (if there is any) |
| Intel | No |  |
| Qualcomm | Yes for NR-DC | UE is allowed to signal a single TDM pattern to gNB that should include some frequency information. If MN observes that the TDM pattern is related to an SN frequency, MN can forward that to SN to take into account. It is not a complicated procedure only sharing IDC information if the UE has indicated it otherwise the IDC problem will not be solved. |
| ZTE | No |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Open Point 5– Additional open issue on whether LTE MN can configure R18 NR IDC for NR side**

During the online discussion one point that came up was whether LTE MN can configure the UE with R18 NR IDC configuration. Company views on this is invited

Question 8 – Do you think whether LTE MN can configure the UE with R18 NR IDC configuration?

**Proposal x: LTE MN does not configure the UE with R18 NR IDC configuration.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answers**  **(Yes/ No)** | **Comments** |
| Xiaomi | No | We understand that the LTE MN may have the intention to resolve the IMD issue between LTE MCG and NR SCG via the enhanced FDM solution. However changing the LTE specification may require lots of discussion on the LTE specification, which seems not reasonable as RAN2 only has one meeting left for Rel-18 IDC. Since we have already had the Rel-15 FDM solution for EN-DC to resolve the IMD issue between MCG and SCG, we would suggest that we move forward to enhance IMD issue only for NR SA. For EN-DC, the harmonic interference issue of NR SN can be supported without extra standard effort. |
| Ericsson | No | It is unnecessary to introduce such optimization. We have already agreed to allow SN can configure the UE with R18 NR IDC for NR side, which is sufficient. LTE MN doesn’t need to understand/intend to configure R18 NR IDC. This means that there is no spec change in LTE spec or NR spec regarding EN-DC. |
| Intel | Yes | We think it is useful at least to address IMD issues. In Rel-15, LTE MN can configure the UE for NR IDC issue, as follows. Similar principle can be applied for Rel-18 enhanced FDM reporting in NR.  IDC-Config-r11 ::= SEQUENCE {  ...,  [[ idc-Indication-MRDC-r15 CHOICE{  release NULL,  setup CandidateServingFreqListNR-r15  } OPTIONAL -- Cond idc-Ind  ]]  } |
| Qualcomm | No strong view | Fine if allowed as the chair has indicated earlier and fine to follow Xiaomi’s suggestion too. |
| ZTE | No strong view |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# 3. Conclusion

After collecting company’s feedbacks, the discussion on the IDC FDM solution enhancements is summarized as follows:

**TBD**

# 4. Text proposal

Text proposal based on the email discussion above is given below for TS38.331 which can be considered as the starting point for capturing the details of providing the gNB configuration and UE reporting for the IDC Enhancements in R18.

Further details to be added if the email discussion converges

*START OF CHANGE FOR UE REPORTING*

#### – *UEAssistanceInformation*

The *UEAssistanceInformation* message is used for the indication of UE assistance information to the network.

Signalling radio bearer: SRB1, SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

*UEAssistanceInformation message*

-- ASN1START

-- TAG-UEASSISTANCEINFORMATION-START

UEAssistanceInformation ::= SEQUENCE {

criticalExtensions CHOICE {

ueAssistanceInformation UEAssistanceInformation-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

*<skipped>*

UEAssistanceInformation-v1610-IEs ::= SEQUENCE {

idc-Assistance-r16 IDC-Assistance-r16 OPTIONAL,

*<skipped>*

nonCriticalExtension UEAssistanceInformation-v1700-IEs OPTIONAL

}

UEAssistanceInformation-v1700-IEs ::= SEQUENCE {

ul-GapFR2-Preference-r17 UL-GapFR2-Preference-r17 OPTIONAL,

musim-Assistance-r17 MUSIM-Assistance-r17 OPTIONAL,

overheatingAssistance-r17 OverheatingAssistance-r17 OPTIONAL,

maxBW-PreferenceFR2-2-r17 MaxBW-PreferenceFR2-2-r17 OPTIONAL,

maxMIMO-LayerPreferenceFR2-2-r17 MaxMIMO-LayerPreferenceFR2-2-r17 OPTIONAL,

minSchedulingOffsetPreferenceExt-r17 MinSchedulingOffsetPreferenceExt-r17 OPTIONAL,

rlm-MeasRelaxationState-r17 BOOLEAN OPTIONAL,

bfd-MeasRelaxationState-r17 BIT STRING (SIZE (1..maxNrofServingCells)) OPTIONAL,

nonSDT-DataIndication-r17 SEQUENCE {

resumeCause-r17 ResumeCause OPTIONAL

} OPTIONAL,

scg-DeactivationPreference ENUMERATED { scgDeactivationPreferred, noPreference } OPTIONAL,

uplinkData-r17 ENUMERATED { true } OPTIONAL,

rrm-MeasRelaxationFulfilment-r17 BOOLEAN OPTIONAL,

propagationDelayDifference-r17 PropagationDelayDifference-r17 OPTIONAL,

nonCriticalExtension UEAssistanceInformation-v18xy-IEs OPTIONAL

}

UEAssistanceInformation-v18xy-IEs ::= SEQUENCE {

idc-Assistance-r18 IDC-Assistance-r18 OPTIONAL, nonCriticalExtension SEQUENCE {} OPTIONAL

}

IDC-Assistance-r16 ::= SEQUENCE {

affectedCarrierFreqList-r16 AffectedCarrierFreqList-r16 OPTIONAL,

affectedCarrierFreqCombList-r16 AffectedCarrierFreqCombList-r16 OPTIONAL,

...

}

IDC-Assistance-r18 ::= SEQUENCE {

fdm-AssistanceInfo-r18 FDM-AssistanceInfo-r18 OPTIONAL,

...

}

FDM-AssistanceInfo-r18::= SEQUENCE {

affectedCarrierFreqRangeList-r18 AffectedCarrierFreqRangeList-r18 OPTIONAL,

affectedCarrierFreqRangeCombList-r18 AffectedCarrierFreqRangeCombList-r18 OPTIONAL,

...

}

AffectedCarrierFreqList-r16 ::= SEQUENCE (SIZE (1.. maxFreqIDC-r16)) OF AffectedCarrierFreq-r16

AffectedCarrierFreq-r16 ::= SEQUENCE {

carrierFreq-r16 ARFCN-ValueNR,

interferenceDirection-r16 ENUMERATED {nr, other, both, spare}

}

AffectedCarrierFreqCombList-r16 ::= SEQUENCE (SIZE (1..maxCombIDC-r16)) OF AffectedCarrierFreqComb-r16

AffectedCarrierFreqComb-r16 ::= SEQUENCE {

affectedCarrierFreqComb-r16 SEQUENCE (SIZE (2..maxNrofServingCells)) OF ARFCN-ValueNR OPTIONAL,

victimSystemType-r16 VictimSystemType-r16

}

VictimSystemType-r16 ::= SEQUENCE {

gps-r16 ENUMERATED {true} OPTIONAL,

glonass-r16 ENUMERATED {true} OPTIONAL,

bds-r16 ENUMERATED {true} OPTIONAL,

galileo-r16 ENUMERATED {true} OPTIONAL,

navIC-r16 ENUMERATED {true} OPTIONAL,

wlan-r16 ENUMERATED {true} OPTIONAL,

bluetooth-r16 ENUMERATED {true} OPTIONAL,

...

}

AffectedCarrierFreqRangeList-r18::= SEQUENCE (SIZE (1.. maxFreqIDC-r18)) OF AffectedCarrierFreqRange-r18

AffectedCarrierFreqRange-r18 ::= SEQUENCE {

centerFreq-r18 ARFCN-ValueNR,

affectedBandwidth-r18 ENUMERATED {mhz5, mhz10, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz200, mhz300, mhz400, FFS\_spare\_values},

interferenceDirection-r16 ENUMERATED {nr, other, both, spare}

Editor‘s Note: affectedBandwidth values are FFS and needs to be fine tuned to cover all the scenarios involving Wi-Fi, GNSS, BT

}

AffectedCarrierFreqRangeCombList-r18::= SEQUENCE (SIZE (1.. maxFreqIDC-r18)) OF AffectedCarrierFreqRangeComb-r18

AffectedCarrierFreqRangeComb-r18::= SEQUENCE {

Editor‘s Note: Details of the ASN.1 structure is FFS

Xiaomi’s Note: The following ASN.1 structure is provided based on the Rel-16 ASN.1 structure for IDC.

affectedCarrierFreqRangeComb-r18 SEQUENCE (SIZE (2..maxNrofServingCells)) OF AffectedCarrierFreqRangeComb-r18 OPTIONAL,

victimSystemType-r18 VictimSystemType-r16

}

AffectedCarrierFreqRangeComb-r18::= SEQUENCE {

centerFreq-r18 ARFCN-ValueNR,

affectedBandwidth-r18 ENUMERATED {mhz5, mhz10, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz200, mhz300, mhz400, FFS\_spare\_values},

}

*<skipped>*

-- TAG-UEASSISTANCEINFORMATION-STOP

-- ASN1STOP

|  |
| --- |
| *UEAssistanceInformation* field descriptions |
| ***affectedCarrierFreqList***  Indicates a list of NR carrier frequencies that are affected by IDC problem. |
| ***affectedCarrierFreqCombList***  Indicates a list of NR carrier frequencie combinations that are affected by IDC problems due to Inter-Modulation Distortion and harmonics from NR when configured with UL CA. |
| ***AffectedCarrierFreqRangeList***  Indicates a list of NR carrier frequencies range that are affected by the IDC problem |
| ***centerFreq***  Indicates the center frequency of the carrier frequency range which is affected by the IDC problem |
| ***affectedBandwidth***  Indicates the bandwidth of the carrier frequency range around the center frequency which is actually affected by the IDC problem. |
| ***affectedCarrierFreqRangeCombList***  Indicates a list of NR carrier frequencie combinations that are affected by IDC problems due to Inter-Modulation Distortion and harmonics from NR when configured with UL CA. |
| ***victimSystemType***  Indicate the list of victim system types to which IDC interference is caused from NR when configured with UL CA. Value *gps*, *glonass*, *bds*, *galileo* and *navIC* indicates the type of GNSS. Value *wlan* indicates WLAN and value *bluetooth* indicates Bluetooth. |

*END OF CHANGE FOR UE REPORTING*

*START OF CHANGE FOR gNB CONFIGURATION*

#### – *OtherConfig*

The IE *OtherConfig* contains configuration related to miscellaneous other configurations.

*OtherConfig* information element

-- ASN1START

-- TAG-OTHERCONFIG-START

OtherConfig ::= SEQUENCE {

delayBudgetReportingConfig CHOICE{

release NULL,

setup SEQUENCE{

delayBudgetReportingProhibitTimer ENUMERATED {s0, s0dot4, s0dot8, s1dot6, s3, s6, s12, s30}

}

} OPTIONAL -- Need M

}

OtherConfig-v1540 ::= SEQUENCE {

overheatingAssistanceConfig SetupRelease {OverheatingAssistanceConfig} OPTIONAL, -- Need M

...

}

CandidateServingFreqListNR-r16 ::= SEQUENCE (SIZE (1..maxFreqIDC-r16)) OF ARFCN-ValueNR

OtherConfig-v1610 ::= SEQUENCE {

idc-AssistanceConfig-r16 SetupRelease {IDC-AssistanceConfig-r16} OPTIONAL, -- Need M

drx-PreferenceConfig-r16 SetupRelease {DRX-PreferenceConfig-r16} OPTIONAL, -- Need M

maxBW-PreferenceConfig-r16 SetupRelease {MaxBW-PreferenceConfig-r16} OPTIONAL, -- Need M

maxCC-PreferenceConfig-r16 SetupRelease {MaxCC-PreferenceConfig-r16} OPTIONAL, -- Need M

maxMIMO-LayerPreferenceConfig-r16 SetupRelease {MaxMIMO-LayerPreferenceConfig-r16} OPTIONAL, -- Need M

minSchedulingOffsetPreferenceConfig-r16 SetupRelease {MinSchedulingOffsetPreferenceConfig-r16} OPTIONAL, -- Need M

releasePreferenceConfig-r16 SetupRelease {ReleasePreferenceConfig-r16} OPTIONAL, -- Need M

referenceTimePreferenceReporting-r16 ENUMERATED {true} OPTIONAL, -- Need R

btNameList-r16 SetupRelease {BT-NameList-r16} OPTIONAL, -- Need M

wlanNameList-r16 SetupRelease {WLAN-NameList-r16} OPTIONAL, -- Need M

sensorNameList-r16 SetupRelease {Sensor-NameList-r16} OPTIONAL, -- Need M

obtainCommonLocation-r16 ENUMERATED {true} OPTIONAL, -- Need R

sl-AssistanceConfigNR-r16 ENUMERATED{true} OPTIONAL -- Need R

}

OtherConfig-v1700 ::= SEQUENCE {

ul-GapFR2-PreferenceConfig-r17 ENUMERATED {true} OPTIONAL, -- Need R

musim-GapAssistanceConfig-r17 SetupRelease {MUSIM-GapAssistanceConfig-r17} OPTIONAL, -- Need M

musim-LeaveAssistanceConfig-r17 SetupRelease {MUSIM-LeaveAssistanceConfig-r17} OPTIONAL, -- Need M

successHO-Config-r17 SetupRelease {SuccessHO-Config-r17} OPTIONAL, -- Need M

maxBW-PreferenceConfigFR2-2-r17 ENUMERATED {true} OPTIONAL, -- Cond maxBW

maxMIMO-LayerPreferenceConfigFR2-2-r17 ENUMERATED {true} OPTIONAL, -- Cond maxMIMO

minSchedulingOffsetPreferenceConfigExt-r17 ENUMERATED {true} OPTIONAL, -- Cond minOffset

rlm-RelaxationReportingConfig-r17 SetupRelease {RLM-RelaxationReportingConfig-r17} OPTIONAL, -- Need M

bfd-RelaxationReportingConfig-r17 SetupRelease {BFD-RelaxationReportingConfig-r17} OPTIONAL, -- Need M

scg-DeactivationPreferenceConfig-r17 SetupRelease {SCG-DeactivationPreferenceConfig-r17} OPTIONAL, -- Cond SCG

rrm-MeasRelaxationReportingConfig-r17 SetupRelease {RRM-MeasRelaxationReportingConfig-r17} OPTIONAL, -- Need M

propDelayDiffReportConfig-r17 SetupRelease {PropDelayDiffReportConfig-r17} OPTIONAL -- Need M

}

OtherConfig-v18Xy ::= SEQUENCE {

idc-AssistanceConfig-r18 SetupRelease {IDC-AssistanceConfig-r18} OPTIONAL -- Need M

}

MUSIM-GapAssistanceConfig-r17 ::= SEQUENCE {

musim-GapProhibitTimer-r17 ENUMERATED {s0, s0dot1, s0dot2, s0dot3, s0dot4, s0dot5, s1, s2, s3, s4, s5, s6, s7, s8, s9, s10}

}

MUSIM-LeaveAssistanceConfig-r17 ::= SEQUENCE {

musim-LeaveWithoutResponseTimer-r17 ENUMERATED {ms10, ms20, ms40, ms60, ms80, ms100, spare2, spare1}

}

SuccessHO-Config-r17 ::= SEQUENCE {

thresholdPercentageT304-r17 ENUMERATED {p40, p60, p80, spare5, spare4, spare3, spare2, spare1} OPTIONAL, --Need R

thresholdPercentageT310-r17 ENUMERATED {p40, p60, p80, spare5, spare4, spare3, spare2, spare1} OPTIONAL, --Need R

thresholdPercentageT312-r17 ENUMERATED {p20, p40, p60, p80, spare4, spare3, spare2, spare1} OPTIONAL, --Need R

sourceDAPS-FailureReporting-r17 ENUMERATED {true} OPTIONAL, --Need R

...

}

OverheatingAssistanceConfig ::= SEQUENCE {

overheatingIndicationProhibitTimer ENUMERATED {s0, s0dot5, s1, s2, s5, s10, s20, s30,

s60, s90, s120, s300, s600, spare3, spare2, spare1}

}

IDC-AssistanceConfig-r16 ::= SEQUENCE {

candidateServingFreqListNR-r16 CandidateServingFreqListNR-r16 OPTIONAL, -- Need R

...

}

DRX-PreferenceConfig-r16 ::= SEQUENCE {

drx-PreferenceProhibitTimer-r16 ENUMERATED {

s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,

s8, s9, s10, s20, s30, spare2, spare1}

}

MaxBW-PreferenceConfig-r16 ::= SEQUENCE {

maxBW-PreferenceProhibitTimer-r16 ENUMERATED {

s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,

s8, s9, s10, s20, s30, spare2, spare1}

}

MaxCC-PreferenceConfig-r16 ::= SEQUENCE {

maxCC-PreferenceProhibitTimer-r16 ENUMERATED {

s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,

s8, s9, s10, s20, s30, spare2, spare1}

}

MaxMIMO-LayerPreferenceConfig-r16 ::= SEQUENCE {

maxMIMO-LayerPreferenceProhibitTimer-r16 ENUMERATED {

s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,

s8, s9, s10, s20, s30, spare2, spare1}

}

MinSchedulingOffsetPreferenceConfig-r16 ::= SEQUENCE {

minSchedulingOffsetPreferenceProhibitTimer-r16 ENUMERATED {

s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,

s8, s9, s10, s20, s30, spare2, spare1}

}

ReleasePreferenceConfig-r16 ::= SEQUENCE {

releasePreferenceProhibitTimer-r16 ENUMERATED {

s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,

s8, s9, s10, s20, s30, infinity, spare1},

connectedReporting ENUMERATED {true} OPTIONAL -- Need R

}

RLM-RelaxationReportingConfig-r17 ::= SEQUENCE {

rlm-RelaxtionReportingProhibitTimer ENUMERATED {s0, s0dot5, s1, s2, s5, s10, s20, s30,

s60, s90, s120, s300, s600, infinity, spare2, spare1}

}

BFD-RelaxationReportingConfig-r17 ::= SEQUENCE {

bfd-RelaxtionReportingProhibitTimer ENUMERATED {s0, s0dot5, s1, s2, s5, s10, s20, s30,

s60, s90, s120, s300, s600, infinity, spare2, spare1}

}

SCG-DeactivationPreferenceConfig-r17 ::= SEQUENCE {

scg-DeactivationPreferenceProhibitTimer-r17 ENUMERATED {

s0, s1, s2, s4, s8, s10, s15, s30,

s60, s120, s180, s240, s300, s600, s900, s1800}

}

RRM-MeasRelaxationReportingConfig-r17 ::= SEQUENCE {

s-SearchDeltaP-Stationary-r17 ENUMERATED {dB2, dB3, dB6, dB9, dB12, dB15, spare2, spare1},

t-SearchDeltaP-Stationary-r17 ENUMERATED {s5, s10, s20, s30, s60, s120, s180, s240, s300, spare7, spare6, spare5,

spare4, spare3, spare2, spare1}

}

PropDelayDiffReportConfig-r17 ::= SEQUENCE {

threshPropDelayDiff-r17 ENUMERATED {ms0dot5, ms1, ms2, ms3, ms4, ms5, ms6 ,ms7, ms8, ms9, ms10, spare5,

spare4, spare3, spare2, spare1} OPTIONAL, -- Need M

neighCellInfoList-r17 SEQUENCE (SIZE (1..maxCellNTN-r17)) OF NeighbourCellInfo-r17 OPTIONAL -- Need M

}

NeighbourCellInfo-r17 ::= SEQUENCE {

epochTime-r17 EpochTime-r17,

ephemerisInfo-r17 EphemerisInfo-r17

}

IDC-AssistanceConfig-r18 ::= SEQUENCE {

candidateServingFreqRangeListNR-r18 CandidateServingFreqRangeListNR-r18 OPTIONAL, -- Need R

...

}

CandidateServingFreqRangeListNR-r18 ::= SEQUENCE (SIZE (1..maxFreqIDC-r18)) OF CandidateServingFreqRangeNR-r18

CandidateServingFreqRangeNR-r18 ::= SEQUENCE {

CenterFreq-r18 ARFCN-ValueNR,

candidateBandwidth-r18 ENUMERATED {mhz5, mhz10, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz200, mhz300, mhz400}

Editor‘s Note: candidateBandwidth-r18 values are FFS

}

-- TAG-OTHERCONFIG-STOP

-- ASN1STOP

| *OtherConfig* field descriptions |
| --- |
| ***bfd-RelaxationReportingConfig***  Configuration for the UE to report the relaxation state of BFD measurements. |
| ***candidateServingFreqListNR***  Indicates for each candidate NR serving cells, the center frequency around which UE is requested to report IDC issues. |
| ***candidateServingFreqRangeListNR***  Indicates for each candidate NR serving cells, the frequency range, indicated by the center frequency and the candidate bandwidth, around which UE is requested to report IDC issues. |
| ***centerFreq***  Indicates the center frequency of the candidate serving frequency range. |
| ***candidateBandwidth***  Indicates the bandwidth of the candidate serving frequency range. |
| ***connectedReporting***  Indicates that the UE can report a preference to remain in RRC\_CONNECTED state following a report to leave RRC\_CONNECTED state. If absent, the UE cannot report a preference to stay in RRC\_CONNECTED state. |
| ***delayBudgetReportingProhibitTimer***  Prohibit timer for delay budget reporting. Value in seconds. Value *s0* means prohibit timer is set to 0 seconds, value *s0dot4* means prohibit timer is set to 0.4 seconds, and so on. |

# 4. Reference

[1] R2-2301486 Summary of [Post120][652][IDC] Further details of FDM solution (Huawei)