3GPP TSG-RAN WG2 Meeting #120 Draft R2-2213008

**Toulouse, France, November, 2022**

Agenda: 9.8

Source: Session Chair (Intel)

Title: Report from IDC breakout session

Document for: Approval

 **Organizational:**

* [AT120][650][IDC] Organizational Yi – IDC (Intel)

 Scope:

* Share plans for the e-meetings and list/status of ongoing email discussions for the sessions.
* Share meeting notes and agreements for review and endorsement.

## 8.10 IDC enhancements for NR and MR-DC

(NR\_IDC\_enh-Core; leading WG: RAN2; REL-18; WID: RP-221281)

Time budget: 1 TU

Tdoc Limitation: 2 tdocs

This WI expects to address interference between 3GPP (including various MR-DC architectures, i.e. NR-DC and EN-DC) and non-3GPP RAT (e.g. WiFi). Note: Enhancements to FDM solution is prioritized. LTE IDC solution should be considered as the baseline for the solutions developed in this WI.

### 8.10.1 Organizational

LS in. Rapporteur Input

### 8.10.2 FDM solution enhancements

Enhancements to FDM solution, to allow more granular indication of affected frequencies (e.g. granularity of BWP or PRB level).

Including the outcome of email discussion [Post119-e][650][IDC] Comparison of FDM solutions (Ericsson). Further discussion on, e.g. stage 3 details of the selected solutions if time is allowed.

[R2-2212420](file:///C%3A%5Cwork%5CRAN2%5CExtracts%5CR2-2212420%20-%20Report%20from%20%5BPost119-e%5D%5B650%5D%5BIDC%5D%20Comparison%20of%20FDM%20solutions%20%28Ericsson%29.docx) Report from [Post119-e][650][IDC] Comparison of FDM solutions (Ericsson) Ericsson discussion Rel-18 NR\_IDC\_enh-Core

Discussion:

Proposal 1 The Rel-18 IDC solution should allow for more granular IDC indications both on serving and on non-serving frequencies.

Proposal 2 Only one single new finer granularity report is introduced, that applies for both serving and non-serving frequencies.

Proposal 3 For LTE, problematic frequencies are indicated by indicating measurement object IDs

Proposal 4 RAN2 down select one of solution 1, 2 or 2a.

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].

Pros:

- Clear how to use for both serving and non-serving, and for EN-DC/NR-DC

- Fine granularity - Possible for the gNB address the IDC issues by avoiding only the impacted PRBs.

Cons:

- More overhead compared to e.g. BWP-based approach

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].

Pro:

- Small signalling overhead.

- Suitable if IDC issues to be addressed by BWP-switching.

- Simple configuration.

Con:

- Limited granularity – Not possible for the gNB to avoid only impacted PRBs.

- Unclear how to make applicable for non-serving.

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

Pros:

- Fine granularity - Possible for the gNB address the IDC issues by avoiding only the impacted PRBs.

- Less overhead compared to Option 1/2/2a.

Cons:

- Unclear how to make applicable for non-serving.

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

* Existing solution for LTE freq;

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

Pros:

- Fine granularity - Possible for the gNB address the IDC issues by avoiding only the impacted PRBs.

Cons:

- Unclear how to make applicable for non-serving

Handling of MR-DC, how to configure IDC for MCG and SCG, report of assistance data for MCG and SCG, etc; Is this also applied for TDM?

[R2-2211740](file:///C%3A%5Cwork%5CRAN2%5CExtracts%5CR2-2211740_IDC%20FDM.doc) Discussion on FDM solutions in IDC Apple discussion Rel-18 NR\_IDC\_enh-Core

Discussion:

Proposal 6: Both MN and SN can configure IDC reporting to UE via SRB1 or SRB3 for the IDC reporting which only involve the carriers from one CG. UE reports IDC to the corresponding network entity via SRB1 or SRB3.

Proposal 7: If the affected carriers are across two CG(s), UE should only report the IDC status to MN and MN is responsible for IDC handling.

The following documents will not be individually treated

R2-2211581 FDM Solutions in IDC Qualcomm Incorporated discussion Rel-18

R2-2211608 Discussion on FDM enhancement Huawei, HiSilicon discussion Rel-18 NR\_IDC\_enh-Core

R2-2211618 Enhanced FDM solution for IDC Intel Corporation discussion Rel-18 NR\_IDC\_enh-Core

R2-2211740 Discussion on FDM solutions in IDC Apple discussion Rel-18 NR\_IDC\_enh-Core

R2-2211756 Discussion on FDM solution enhancements for IDC OPPO discussion Rel-18 NR\_IDC\_enh-Core

R2-2211969 FDM solutions Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_IDC\_enh-Core

R2-2211979 Discussion on the FDM Option 1 and 2 Xiaomi discussion Rel-18 NR\_IDC\_enh-Core

R2-2212412 More granular FDM indications Ericsson discussion Rel-18

R2-2212652 Discussion on FDM solution for R18 IDC vivo discussion Rel-18 NR\_IDC\_enh-Core

R2-2212668 Discussion on FDM solution enhancements Sharp discussion

R2-2212743 Further Consideration on the IDC FDM Solutions ZTE Corporation, Sanechips discussion Rel-18 NR\_IDC\_enh-Core

R2-2212816 Discussion on FDM solution for IDC Samsung discussion Rel-18 NR\_IDC\_enh-Core

R2-2212921 IDC FDM solution LG Electronics discussion Rel-18 NR\_IDC\_enh-Core

R2-2212931 FDM solution for IDC Lenovo discussion Rel-18 NR\_IDC\_enh-Core

### 8.10.3 TDM solution

Introduction of TDM solution (e.g. indication of UE preferred TDM pattern for UL/DL).
Note: The TDM solution is considered complementary to the FDM solution.

Including the outcome of email discussion [Post119-e][651][IDC] Comparison of TDM solutions (Xiaomi). Further discussion on, e.g. stage 3 details of the selected solutions if time is allowed.

[R2-2211978](file:///C%3A%5Cwork%5CRAN2%5CExtracts%5CR2-2211978_Summary%20of%20the%20comparison%20of%20TDM%20solutions%20%28Xiaomi%29.docx) Summary of [Post119-e][651][IDC] Comparison of TDM solutions (Xiaomi) Xiaomi discussion Rel-18 NR\_IDC\_enh-Core Late

Discussion:

Proposal 1 (11/14): Option 1 (i.e. DRX solution) is supported in Rel-18.

Proposal 2 (13/14): Option 3 (i.e. UL and/or DL transmission occasion(s) solution) is not supported in Rel-18.

Proposal 3: RAN2 is kindly requested to discuss which of the following solutions should also be considered in Rel-18:

 Option 2：MUSIM gap-like solution (6/14)

 Option 4: Autonomous denial solution (7/14)

Proposal 4: Depending on the down-selection result of the TDM solutions, the solutions (with the list of FFS issues) provided from the Phase-1 discussion can be considered as the baseline for further study.

**Observation 1: The benefits and drawbacks of the DRX solution are listed as follows:**

|  |  |  |
| --- | --- | --- |
|  | **Benefits** | **Drawbacks** |
| **DRX solution** | * Applicalbe for all traffic type, and more suitable for periodic traffic
* Finer granularity than MUSIM gap-lik solution
* The stable LTE baseline can be easily implemented in NR
 | * Not suitable for aperiodic service (e.g. some events during BT/WiFi connection-setup or other important signalling)
* Not suitable for some periodic service with smaller cycle (e.g. BT eSCO with 3.75ms cycle).
* Complex on multiple DRX timers
* Stopping all UL transmission is a bit overkill for IMD issue.
* Stopping both UL and DL transmission is a bit overkill when the intereferenc is UL-only or DL-only.
 |

**Observation 2: The benefits and drawbacks of the MUSIM gap-like solution are listed as follows:**

|  |  |  |
| --- | --- | --- |
|  | **Benefits** | **Drawbacks** |
| **MUSIM gap-like solution** | * Applicable for all traffic type
* Can reuse Rel-17 MUSIM framework
* Can react quickly to request for aperiodic gaps
 | * Not suitable for some periodic service with smaller cycle (e.g. BT eSCO with 3.75ms cycle).
* Coarser granurity than DRX solution
* Stopping all UL transmission is a bit overkill for IMD issue.
* Stopping both UL and DL transmission is a bit overkill when the intereferenc is UL-only or DL-only.
* More standard efforts than DRX due to unclear changes (e.g. more granularities) in the specification by using the Rel-17 MUSIM gap-like solution for IDC
* Whether/which the MUSIM gap-like solution (e.g. periodic gap or aperiodic gap) applicable for resolving the IDC issue may need RAN4 evaluation.
* It is unclear whether we need multiple patterns, hysteresis etc.
* It is unclear how the Rel-18 MUSIM work impacts the Rel-18 IDC solution.
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**Observation 3: The benefits and drawbacks of the UL and/or DL transmission occasion(s) solution are listed as follows:**

|  |  |  |
| --- | --- | --- |
|  | **Benefits** | **Drawbacks** |
| **UL and/or DL transmission occasion(s) solution** | * Applicalbe for all traffic type including periodic traffic and aperiodic traffic
* Can support the BT voice (eSCO) use case
* The DL and UL differentiation can provide more fine time domain separation between 3GPP and non-3GPP module
 | * More standard efforts on finding a proper UL/DL pattern in NR, as which UL/DL pattern is applicable for NR and IDC is still unclear.
* It is unclear how the pattern is adaptive to the NR asynchronous HARQ and the flexible TDD pattern.
* Complex for the implementation of both the UE and the gNB, since it is difficult to change the TDD configuration provided by the gNB.
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**Observation 4: The benefits and drawbacks of the autonomous denial solution are listed as follows:**

|  |  |  |
| --- | --- | --- |
|  | **Benefits** | **Drawbacks** |
| **Autonomous denial solution** | * Applicalbe for all traffic type including periodic traffic and aperiodic traffic, e.g., WiFi beacons and other connection setup events.
* More applicable for IMD issue, compared with other solutions.
* Very fast reaction time since it does not rely on signalling to obtain the gap in time.
* Does not need very stringent coordination between RATs.
* The LTE baseline can be reused in NR.
* Can work as a complementory solution with other TDM solution
 | * Not applicable for resolving DL interference to NR.
* Reduced cell throughput due to missed PUSCH.
* May trigger link adaptation and increased PDCCH load.
* It is difficult to work as a standalone solution. May lead to the increased market fragmentation
* Need new RAN4 performance requirements.
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Handling of MR-DC for TDM, how to configure IDC for MCG and SCG, report of assistance data for MCG and SCG, etc; May not be treated if the agreements made for FDM is applied for TDM;

[R2-2211609](file:///C%3A%5Cwork%5CRAN2%5CExtracts%5CR2-2211609%20Discussion%20on%20TDM%20solution%20for%20NR%20IDC.docx) Discussion on TDM solution for NR IDC Huawei, HiSilicon discussion Rel-18 NR\_IDC\_enh-Core

Discussion:

Proposal 5: To support the TDM solution as in Proposal 4 for scenario 1-2,

- If SRB3 is not configured: SN configures the reporting of the UE suggested TDM pattern information via SRB1 by using the RRCReconfiguration container to the UE, and UE reports the IDC assistance information with UE suggested TDM pattern information to SN via SRB1 by reporting UAI in the *ULInformationTransferMRDC* message

- if SRB3 is configured: SN configures the reporting of the UE suggested TDM pattern information to the UE via SRB3, and UE reports the IDC assistance information with UE suggested TDM pattern information to SN via SRB3

The following documents will not be individually treated

R2-2211583 TDM Solutions in IDC Qualcomm Incorporated discussion Rel-18

R2-2211619 TDM solution for IDC Intel Corporation discussion Rel-18 NR\_IDC\_enh-Core

R2-2211741 Discussion on TDM solutions in IDC Apple discussion Rel-18 NR\_IDC\_enh-Core

R2-2211757 Discussion on TDM solutions for IDC OPPO discussion Rel-18 NR\_IDC\_enh-Core

R2-2211970 TDM solutions Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_IDC\_enh-Core

R2-2211980 Discussion on the TDM Option 1 and 4 Xiaomi discussion Rel-18 NR\_IDC\_enh-Core

R2-2212004 NR IDC TDM solutions and indications Ericsson discussion Rel-18 NR\_IDC\_enh-Core

R2-2212653 MUSIM gap like solution for IDC vivo discussion Rel-18 NR\_IDC\_enh-Core

R2-2212742 Further Consideration on the IDC TDM Solutions ZTE Corporation, Sanechips discussion Rel-18 NR\_IDC\_enh-Core

R2-2212817 Discussion on TDM solution for IDC Samsung discussion Rel-18 NR\_IDC\_enh-Core