**3GPP TSG-RAN WG2 Meeting #121 R2-23xxxx**

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

**Agenda item: 8.10.3**

**Source: vivo**

**Title: [AT121][651][IDC]Discussion on TDM solution (vivo, xiaomi)**

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

# 1. Introduction

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

* [AT121][651][IDC] Discussion on TDM solution (vivo, xiaomi)

 Scope: Continue the discussion on leftover issues, and provide draft TP to capture agreements in this meeting. Draft LS to RAN4

 Intended outcome: Report to Friday CB session in R2-2302072

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

## 1.1 Contacts

Contact person for each participating company:

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Vivo | Xiaodong Yang | Yangxiaodong5g@vivo.com |
| xiaomi | Yumin Wu | wuyumin@xiaomi.com |
| Intel | Yujian Zhang | yujian.zhang@intel.com |
| Qualcomm | Sherif ElAzzouni | selazzou@qti.qualcomm.com |
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# 2. Discussion

The RAN2 agreements related to the IDC TDM solutions are quoted as follows:

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| RAN2#121 meeting agreements:* Agreed: With changing version to “UEAssistanceInformation-v18xy-IEs” ,TDM-AssistanceInfo-r18 to “SEQUENCE” and removing “periodicPatternInfo-r11”, UEAssistanceInformation of the ASN.1 framework and field description in section 4 for the periodic pattern is taken as starting point.
* The NR values of long/short DRX cycle and start offset are used for periodic pattern. RAN2 will not introduce new DRX value for network configuration for IDC purpose.
* The slot offset with 1/32ms granularity is included in UEAssistanceInformation-v18xy-IEs for start offset.
* Multiple periodic patterns for IDC are not supported in R18.
* 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.
* FFS whether any additional coordination is needed for network to resolve the problem when network receives the reporting from UE.
* Slot as time unit. Note: it is used for autonomous denial.
* Agree to send LS to RAN4, indicate the progress in RAN2 in [651].
 |

## 2.1 Periodic pattern

Regarding periodic pattern, one remaining issue is “how to configure the UE to report the TDM assistance information”.

In legacy, UE is configured via *idc-AssistanceConfig IE* to report assistance information to inform the gNB about UE detected IDC problem. TDM assistant information, as a Rel-18 IDC feature, should not be reported to legacy gNB, e.g., R17 gNB. It’s proposed in email[1] to discuss whether *idc-AssistanceConfig-r18* for TDM assistant information allowing shall be added.

Furthermore, we have agreed in RAN2#121 that “per CG pattern is supported for MR-DC”. In rapporteur’s understanding, SN could use the same mechanism to configure the UE to report the TDM assistance information.

The ASN.1 example in *OtherConfig* IE is as below:

IDC-AssistanceConfig-r16 ::= SEQUENCE {

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

...,

[[idc-AssistanceConfig-r18 ENUMERATED {setup} OPTIONAL -- Need M

]]

}

| *OtherConfig* field descriptions |
| --- |
| ***idc-AssistanceConfig***Configuration for the UE to report assistance information to inform the gNB about UE detected IDC problem. |
| ***idc-AssistanceConfig-r18***The field is used to indicate whether the UE is configured to report assistance information for TDM assistant information.  |

#### Question 1: Do you agree that *idc-AssistanceConfig-r18* for TDM assistant information allowing shall be added for both MN and SN?

**Proposal x: *idc-AssistanceConfig-r18* is per CG.**

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| **Company** | **Answers** **(Yes/No)** | **Comments** |
| Vivo | Yes | we think *idc-AssistanceConfig-r18*for TDM assistant information allowing shall be added, because TDM assistant information should not report to legacy gNB, e.g., R17 gNB. For MR-DC case, it shall be set per node.  |
| Xiaomi | Yes | We think that we anyway need a new configuration for Rel-18 TDM reporting, which should be per CG (i.e. same as Rel-16). We may merge the configurations for FDM and TDM, if RAN2 agreed that FDM and TDM assistance information are binded UE capabilities. According to LTE IDC solution, the UE is only allowed to report TDM assistance information when the affected frequency is also reported. Only reporting TDM pattern seems not useful, as the gNB does not know which frequency should use the TDM pattern.. |
| Intel | Yes | Maybe the field name can be renamed to something like *tdm-AssistanceConfig-r18* if it is only used to configure TDM assistance information? |
| Ericsson | Yes | We see reporting (config) per CG, and also supported w/o coordination. Renaming as suggested by Intel is good. |
| Qualcomm | Yes | Fine to configure to avoid UE reporting needlessly |
| ZTE | See comments | idc-AssistanceConfig-r18 is needed per CG. However we don’t think there is a need to introduce a configuration for the TDM in the “Other config”.In the legacy, the network would configure a candidate frequency list, and the UE would report TDM assistance information (if have) together with the affected frequencies. Thus we think for the SN, the SN also only need to configure the candidate frequency list, then it’s up to UE to determine whether to report the TDM assistance information for the affected frequency ranges. |
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**Summary:**

TBD.

Regarding the values of periodic pattern recommended by the UE, we have achived below agreements:

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| * The NR values of long/short DRX cycle and start offset are used for periodic pattern. RAN2 will not introduce new DRX value for network configuration for IDC purpose.
* The slot offset with 1/32ms granularity is included in UEAssistanceInformation-v18xy-IEs for start offset.
 |

In LTE, the TDM assistance information also includes activation time in addition to DRX cycle, offset.

TDM-AssistanceInfo-r11 ::= CHOICE {

 drx-AssistanceInfo-r11 SEQUENCE {

 drx-CycleLength-r11 ENUMERATED {sf40, sf64, sf80, sf128, sf160,

 sf256, spare2, spare1},

 drx-Offset-r11 INTEGER (0..255) OPTIONAL,

 drx-ActiveTime-r11 ENUMERATED {sf20, sf30, sf40, sf60, sf80,

 sf100, spare2, spare1}

 },

In NR, the DRX values are quoted as follows:

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| --- |
| 38.331:drx-onDurationTimer CHOICE { subMilliSeconds INTEGER (1..31), milliSeconds ENUMERATED { ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60, ms80, ms100, ms200, ms300, ms400, ms500, ms600, ms800, ms1000, ms1200, ms1600, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 } }, |

For NR is better to have the activation timer after including the NR values of long/short DRX cycle and start offset.

UEAssistanceInformation-v18xy-IEs ::= SEQUENCE {

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

}

IDC-Assistance-r18 ::= SEQUENCE {

tdm-AssistanceInfo-r18 TDM-AssistanceInfo-r18 OPTIONAL,

 ...

}

TDM-AssistanceInfo-r18 ::= SEQUENCE {

 cycleLength-r18 ENUMERATED { ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32, ms35, ms40, ms60, ms64, ms70, ms80, ms128, ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, ms2048, ms2560, ms5120, ms10240, spare1},

 startOffset-r18 INTEGER (0..10239) OPTIONAL,

 startOffset-slotOffset-r18 INTEGER (0..31) OPTIONAL,

 activeDuration-r18 ENUMERATED { ms1, ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms15, ms16, ms17, ms20, ms30, ms32, ms35, ms40, ms60, ms80, ms100, ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, ms2048, ms2560, ms5120, spare2, spare1},

 ...

}

#### Question 2: Do you think activation duration shall be included in TDM assistance information and what values if included?

**Proposal x: The values of *drx-onDurationTimer* is used as the baseline. FFS on other values.**

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| **Company** | **Answers** **(Yes/No)** | **Comments** |
| vivo | Yes | The activation duration Value can be” ms1, ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms15, ms16, ms17, ms20, ms30, ms32, ms35, ms40, ms60, ms80, ms100, ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, ms2048, ms2560, ms5120”. |
| Xiaomi | Yes | The values of *drx-onDurationTimer* can be used as the baseline according to previous RAN2 agreements. Other values can be discussed further. |
| Intel | Yes |  |
| Ericsson | Yes, comment | Baseline w current values only and discuss additions later. |
| Qualcomm | Yes | Can verify if any other values are needed next meeting |
| ZTE | Yes, comment | We think1/32 granularity shall also be included for the activation duration, otherwise we don’t see to meaning to included it for the values of the start offset. |
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**Summary:**

TBD.

Based on the text proposal in email[1], we have the text proposal of TS38.331 for signalling procedure as below:

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| 5.7.4 UE Assistance Information5.7.4.2 Initiation*<skipped>*A UE capable of providing IDC assistance information in RRC\_CONNECTED may initiate the procedure if it was configured to do so, upon detecting IDC problem if the UE did not transmit an IDC assistance information since it was configured to provide IDC indications, or upon change of IDC problem information.*<skipped>*Upon initiating the procedure, the UE shall: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; or3> 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.5.7.4.3 Actions related to transmission of *UEAssistanceInformation* messageThe UE shall set the contents of the *UEAssistanceInformation* message as follows:*<skipped>*1> if transmission of the *UEAssistanceInformation* message is initiated to provide IDC assistance information according to 5.7.4.2 or 5.3.5.3:2> if there is at least one carrier frequency included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:3> include the field *affectedCarrierFreqList* with an entry for each affected carrier frequency included in *candidateServingFreqListNR*;3> for each carrier frequency included in the field *affectedCarrierFreqList*, include *interferenceDirection* and set it accordingly;3> if *idc-AssistanceConfig-r18* is configured; 4> include *tdm-AssistanceInfo* information by setting *cycleLength*, *startOffset,* *startOffset-slotOffset* and *activeDuration accordingly* unless the UE has no Time Doman Multiplexing based assistance information that could be used to resolve the IDC problems:2> if there is at least one supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:3> include *victimSystemType* for each UL CA combination included in *affectedCarrierFreqCombList*;3> if the UE sets *victimSystemType* to *wlan* or *bluetooth*:4> include *affectedCarrierFreqCombList* with an entry for each supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, that is affected by IDC problems;3> else:4> optionally include *affectedCarrierFreqCombList* with an entry for each supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, that is affected by IDC problems;NOTE 1: When sending an *UEAssistanceInformation* message to inform the IDC problems, the UE includes all IDC assistance information (rather than providing e.g. the changed part(s) of the IDC assistance information).NOTE 2: Upon not anymore experiencing a particular IDC problem that the UE previously reported, the UE provides an IDC indication with the modified contents of the *UEAssistanceInformation* message (e.g. by not including the IDC assistance information in the *idc-Assistance* field). |

#### Question 3: Do you agree the above signaling procedure of TDM?

**Proposal x: The signaling procedure of TDM as provided in the paper is used for the CR drafting.**

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| **Company** | **Answers** **(Yes/No)** | **Comments** |
| vivo | Yes | As Q1 discussed, *idc-AssistanceConfig-r18* for TDM assistant information allowing should be added. |
| Xiaomi | Yes | The abve text proposals can be taken as the baseline for CR drafting. Companies can polish the texts further during post-meeting email discussion. |
| Intel | Yes |  |
| Ericsson | Comment | The text/procedure can be improved, e.g. “by setting” is unclear and maybe just refer to what is provided (as in other procedures). The condition to include/or not can be made before separately etc. |
| Qualcomm | No | TDM and FDM are needlessly tied here. Why would FDM has to be configured to trigger a TDM report. As we mentioned, we already have a very important NTN use case where only TDM solution is available so why would TDM be on top of FDM is an FDM solution is unneeded.  |
| ZTE | See comments | We don’t think there is a need to introduce a separate configuration bit for the TDM. |
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**Summary:**

TBD.

## 2.2 Autonomous denial

RAN2#121 agreed to use slot as time unit for autonomous denial.

Company contribution[2] suggest that the same values of validity period and number of time unit as in LTE is reused in NR , i.e. to define the maximum number of scheduled UL transmission that that the UE can deny in one period. Contribution[3][4] thinks the LTE validity value can be reused unless new cases are identified.

The network configuration of LTE autonomous denial solution is quoted as follows:

 autonomousDenialParameters-r11 SEQUENCE {

 autonomousDenialSubframes-r11 ENUMERATED {n2, n5, n10, n15,

 n20, n30, spare2, spare1},

 autonomousDenialValidity-r11 ENUMERATED {

 sf200, sf500, sf1000, sf2000,

 spare4, spare3, spare2, spare1}

 } OPTIONAL, -- Need OR

In rapporteur’s understanding, if we use the same values of validity period and number of denial slot, the validity period should be number of slots, i.e, to keep the similar denial rate as LTE. If we reuse LTE validity period(ms), the numer of denial slots should not reuse LTE value. Based on company contribution, there could be below options:

**Option 1: the same values of validity period and number of denial slots as in LTE is reused**

Taking LTE configuration as baseline, the ASN.1 is drafted as below:

IDC-AssistanceConfig-r16 ::= SEQUENCE {

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

...,

 [[autonomousDenialParameters-r18 SEQUENCE {

 autonomousDenialSlots-r18 ENUMERATED { n2, n5, n10, n15,

 n20, n30, spare2, spare1},

 autonomousDenialValidity-r18 ENUMERATED { n200, n500, n1000, n2000,

 spare4, spare3, spare2, spare1}

 } OPTIONAL -- Need R

]]

}

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| --- |
| *OtherConfig* field descriptions |
| ***AutonomousDenialSlots***Indicates the maximum number of the UL slots for which the UE is allowed to deny any UL transmission. Value n2 corresponds to 2 slots, n5 to 5 slots and so on.  |
| ***AutonomousDenialValidity***Indicates the validity period over which the UL autonomous denial slots shall be counted. Value n200 corresponds to 200 slots, n500 corresponds to 500 slots and so on. |

#### Question 4: What’s the values of validity period and number of denial slots?

Option 1: the same values of validity period and number of denial slots as in LTE is reused

Option 2: others, Please give the detailed values.

**Proposal x: The same values of validity period and number of denial slots as in LTE is reused.**

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| **Company** | **Answers** **(Option 1/2)** | **Comments** |
| vivo | 1  | Option-1 is simple, and keep the same denial rate as LTE. |
| Xiaomi | 1 | The LTE values can be used as the baseline. Other values can be discussed based on company contributions. |
| Intel | 1 |  |
| Qualcomm | 1 | Agree with Xiaomi |
| ZTE | 1 |  |
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**Summary:**

TBD.

The text proposal for the autonomous denial solution for NR is drafted as follows.

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| 5.3.5 RRC reconfiguration5.3.5.9 Other configurationThe UE shall:1> if the received *otherConfig* includes the *idc-AssistanceConfig*:2> if *idc-AssistanceConfig* is set to *setup*:3> consider itself to be configured to provide IDC assistance information in accordance with 5.7.4;2> else:3> consider itself not to be configured to provide IDC assistance information;2> if *autonomousDenialParameters* is included:3> consider itself to be allowed to deny any transmission in a particular slot if during the number of slots indicated by *autonomousDenialValidity*, preceeding and including this particular slot, it autonomously denied fewer slots than indicated by *autonomousDenialSlots*; |

#### Question 5: Do you agree the signalling procedure of autonomous denial?

**Proposal X: The signalling procedure of autonomous denial as provided in the paper is used for the CR drafting.**

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| **Company** | **Answers** **(Yes/No)** | **Comments** |
| vivo | Yes |  |
| Xiaomi | Yes | It seems that the LTE text can already cover all cases. |
| Intel | Yes |  |
| Qualcomm | Yes |  |
| ZTE | Yes |  |
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**Summary:**

TBD.

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| 5.3.5 RRC reconfiguration5.3.5.9 Other configurationThe UE shall:1> if the received *otherConfig* includes the *idc-AssistanceConfig*:2> if *idc-AssistanceConfig* is set to *setup*:3> consider itself to be configured to provide IDC assistance information in accordance with 5.7.4;2> else:3> consider itself not to be configured to provide IDC assistance information;2> if *autonomousDenialParameters* is included:3> consider itself to be allowed to deny any transmission in a particular slot if during the number of slots indicated by *autonomousDenialValidity*, preceeding and including this particular slot, it autonomously denied fewer slots than indicated by *autonomousDenialSlots*; |

#### Question 6: Do you agree that the autonomous denial configuration is per CG?

**Proposal X: The autonomous denial configuration is per CG.**

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| --- | --- | --- |
| **Company** | **Answers** **(Yes/No)** | **Comments** |
| Xiaomi | Yes |  |
| Intel | Yes |  |
| Qualcomm | Yes |  |
| ZTE | Yes |  |
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**Summary:**

TBD.

## 2.3 Draft LS to RAN4

We agree to send LS to RAN4, indicate the progress in RAN2.

The draft LS to RAN4 is as below.

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| **Title:** LS to RAN4 on IDC**Response to:** **Release:** Release 18**Work Items:** NR\_IDC\_enh-Core**Source:** RAN WG2**To:** RAN WG4**CC:** **Contact Person:****Name:** **E-mail Address:** **Send any reply LS to: 3GPP Liaisons Coordinator, mailto:3GPPLiaison@etsi.org****Attachments:** **None**1 Overall descriptionRAN2 has agreed to introduce autonomous denial configuration for the NR IDC issue. The time unit for autonomous denial configuration is slot. This means that the UE is allowed to deny any transmission in a particular slot if during the number of slots indicated by *autonomousDenialValidity*, preceeding and including this particular slot, it autonomously denied fewer slots than indicated by *autonomousDenialSlots.* For the autonomous denial parameters, the following values are agreed for both single CC and carrier aggregation cases. RAN2 also observed that the autonomous denial solution may require new RRM requirements in RAN4, as LTE.autonomousDenialParameters-r18 SEQUENCE { autonomousDenialSlots-r18 ENUMERATED { n2, n5, n10, n15, n20, n30, spare2, spare1}, autonomousDenialValidity-r18 ENUMERATED { n200, n500, n1000, n2000, spare4, spare3, spare2, spare1}2 Actions**To RAN4****ACTION:** RAN2 kindly asks RAN4 to take the above information into account for the further work, and define the corresponding RRM requirements if needed.3 Dates of next TSG RAN WG2 meetingsTSG-RAN WG2 Meeting #121bis-e 17th April – 26th April 2023 E-meetingTSG-RAN WG2 Meeting #122 22nd May – 26th May 2023 Incheon, KR |

#### Question 7: Do you agree the wording of drafted LS to RAN4?

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| **Company** | **Answers** **(Yes/No)** | **Comments** |
| vivo | Yes |  |
| Xiaomi | Yes |  |
| Intel | Yes |  |
| Qualcomm | Yes |  |
| ZTE | Yes |  |
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**Summary:**

TBD.

# 3. Conclusion

**TBD.**

# 4. Text proposal

To be updated according to conclusion

TS38.331 Text proposal is updated according to company comments and conclusion.

*START OF CHANGE*

### 5.3.5 RRC reconfiguration

#### 5.3.5.9 Other configuration

The UE shall:

1> if the received *otherConfig* includes the *idc-AssistanceConfig*:

2> if *idc-AssistanceConfig* is set to *setup*:

3> consider itself to be configured to provide IDC assistance information in accordance with 5.7.4;

2> else:

3> consider itself not to be configured to provide IDC assistance information;

2> if *autonomousDenialParameters* is included:

3> consider itself to be allowed to deny any transmission in a particular slot if during the number of slots indicated by *autonomousDenialValidity*, preceeding and including this particular slot, it autonomously denied fewer slots than indicated by *autonomousDenialSlots*;

Editor’s Note: FFS *idc-AssistanceConfig-r18* for TDM assistant information allowing.

### 5.7.4 UE Assistance Information

#### 5.7.4.2 Initiation

*<skipped>*

A UE capable of providing IDC assistance information in RRC\_CONNECTED may initiate the procedure if it was configured to do so, upon detecting IDC problem if the UE did not transmit an IDC assistance information since it was configured to provide IDC indications, or upon change of IDC problem information.

*<skipped>*

Upon initiating the procedure, the UE shall:

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.

#### 5.7.4.3 Actions related to transmission of *UEAssistanceInformation* message

The UE shall set the contents of the *UEAssistanceInformation* message as follows:

*<skipped>*

1> if transmission of the *UEAssistanceInformation* message is initiated to provide IDC assistance information according to 5.7.4.2 or 5.3.5.3:

2> if there is at least one carrier frequency included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:

3> include the field *affectedCarrierFreqList* with an entry for each affected carrier frequency included in *candidateServingFreqListNR*;

3> for each carrier frequency included in the field *affectedCarrierFreqList*, include *interferenceDirection* and set it accordingly;

3> include Time Domain Multiplexing (TDM) based assistance information, unless the UE has no Time Doman Multiplexing based assistance information that could be used to resolve the IDC problems:

4> if the UE has periodic pattern related assistance information that could be used to resolve the IDC problems,

5> include *cycleLength*, *startOffset*, *startOffset-slotOffset* and *activeDuration*;

2> if there is at least one supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:

3> include *victimSystemType* for each UL CA combination included in *affectedCarrierFreqCombList*;

3> if the UE sets *victimSystemType* to *wlan* or *bluetooth*:

4> include *affectedCarrierFreqCombList* with an entry for each supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, that is affected by IDC problems;

3> else:

4> optionally include *affectedCarrierFreqCombList* with an entry for each supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, that is affected by IDC problems;

NOTE 1: When sending an *UEAssistanceInformation* message to inform the IDC problems, the UE includes all IDC assistance information (rather than providing e.g. the changed part(s) of the IDC assistance information).

NOTE 2: Upon not anymore experiencing a particular IDC problem that the UE previously reported, the UE provides an IDC indication with the modified contents of the *UEAssistanceInformation* message (e.g. by not including the IDC assistance information in the *idc-Assistance* field).

### 6.2.2 Message definitions

#### – *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 {

tdm-AssistanceInfo-r18 TDM-AssistanceInfo-r18 OPTIONAL,

 ...

}

TDM-AssistanceInfo-r18 ::= SEQUENCE {

 cycleLength-r18 ENUMERATED { ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32, ms35, ms40, ms60, ms64, ms70, ms80, ms128, ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, ms2048, ms2560, ms5120, ms10240, spare1},

 startOffset-r18 INTEGER (0..10239) OPTIONAL,

 startOffset-slotOffset-r18 INTEGER (0..31) OPTIONAL,

 activeDuration-r18 ENUMERATED { ms1, ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms15, ms16, ms17, ms20, ms30, ms32, ms35, ms40, ms60, ms80, ms100, ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, ms2048, ms2560, ms5120, spare2, spare1},

 ...

}

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,

 ...

}

*<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. |
| ***ActiveDuration***Indicates the desired active duration of periodic pattern that the NR is recommended to configure. FFS Value. |
| ***CycleLength***Indicates the desired cycle length of periodic pattern that the NR is recommended to configure. FFS Value. |
| ***StartOffset***Indicates the desired starting offset of periodic pattern that the NR is recommended to configure. The UE shall set the value of startOffset smaller than the value of c*ycleLength*. |
| ***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. |

### 6.3.4 Other information elements

#### – *OtherConfig*

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

*OtherConfig* information element

*<skipped>*

IDC-AssistanceConfig-r16 ::= SEQUENCE {

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

...,

 [[autonomousDenialParameters-r18 SEQUENCE {

 autonomousDenialSlots-r18 ENUMERATED {FFS},

 autonomousDenialValidity-r18 ENUMERATED {FFS}

 } OPTIONAL -- Need R

]]

}

| *OtherConfig* field descriptions |
| --- |
| ***idc-AssistanceConfig***Configuration for the UE to report assistance information to inform the gNB about UE detected IDC problem. |
| ***AutonomousDenialSlots***Indicates the maximum number of the slots for which the UE is allowed to deny any UL transmission.. |
| ***AutonomousDenialValidity***Indicates the validity period over which the UL autonomous denial shall be counted. |

*END OF CHANGE*

# 5. Reference

[1] R2-2301599\_Summary of [Post120][651][IDC]Further details of TDM solution (vivo)

[2] R2-2301488 Further discussion on details of TDM solution for NR IDC Huawei, HiSilicon

[3] R2-2301327 Discussion on TDM solution for IDC Samsung

[4] R2-2301600 Discussion on IDC TDM solution vivo