**3GPP TSG-RAN WG2 Meeting #109bis-e R2-20xxxxx**

**Electronic, 20 April – 30 April 2020**

**Agenda Item:** 6.20.1.1

**Source:** Huawei, HiSilicon

**Title:** [AT109bis-e][050][TEI16] Overheating (Huawei)

**WI code(s):** TEI16

**Document for:** Discussion and Decision

## 1 Introduction

This document is to kick off the below offline discussion:

**Overheating**

[R2-2003467](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003467.zip) 36.331 CR for addressing overheating issue in (NG)EN-DC Huawei, Huawei Device, Apple, CATT CR Rel-16 36.331 16.0.0 4176 2 F TEI16 R2-2001325

[R2-2003468](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003468.zip) 38.331 CR for addressing overheating issue in (NG)EN-DC Huawei, Huawei Device, Apple, CATT CR Rel-16 38.331 16.0.0 1413 2 F TEI16 R2-2001326

* [AT109bis-e][050][TEI16] Overheating (Huawei)

Scope: Treat papers above on Overheating.

Wanted Outcome: Agreed solution, if possible Agreed-in-principle CR(s)

Deadline: April 28 0700 UTC

## 2 Discussion

### 2.1 Overheating assistance information for SCG in LTE UAI message in (NG)EN-DC

The overheating assistance defined in TS 38.331 is added in LTE UE assistance information, this new field indicates the overheating assistance information for SCG in (NG)EN-DC. To simplify the ASN.1 signaling design, the new field refers to the NR *OverheatingAssistance* IE in TS 38.331 and indicates the UE's preference on reduced configuration for NR SCG. If UE reports the new field (overheating assistance for SCG), MN can just transfers it to SN.

The associated main changes in TS 36.331 are given below.

UEAssistanceInformation-v16xy-IEs ::= SEQUENCE {

overheatingAssistanceForSCG-r16 OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

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| --- |
| ***overheatingAssistanceForSCG***  Includes the NR *OverheatingAssistance* IE as specified in TS 38.331 [82]. The field indicates UE's preference on reduced configuration for NR SCG. |

**2.1 Companies are encouraged to provide the comments for the analyses and changes in CR above.**

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| Company | Comments |
| OPPO | Based on the change above, it means that overheatingAssistanceForSCG will be report to the MN as container. Right?  If so, do you think it is possible to report overheatingAssistanceForSCG to SN directly over SRB3 if configured? |
| Google | The changes look OK. |
| BT | Agree with Oppo. Why is not possible to have both options, to MN as container and via SRB3? |
| Nokia,  Nokia Shanghai Bell | We think SRB3 wasn’t agreed, but MN involvement and transfer through the MN.  To us the most important aspect to ensure is backward compatibility:  For the reducedCCsDL/UL, since it has already been introduced in EN-DC in Rel-15 and should be interpreted as the total number of SCell across MCG and SCG in EN-DC (see the field description). We understand we don’t change this interpretation to guarantee the backward compatibility.  Backward compatibility can be ensured by the presence of the new IE: new IE not present => legacy behavior, new IE present => new behavior.  The easiest solution would be that the new IE represents the SCG overheating information, and that the legacy IE represents the MCG overheating information when the new IE is present, and the MCG+SCG overheating information when the new IE is not present.  The current assumption with the CR is that:  NOTE 5: UE is not allowed to include reducedMaxCCs in both overheatingAssistance and overheatingAssistanceForSCG simultaneously.  We are not clear about the NOTE meaning in that context, does the UE includes then MCS+SCG information in the new field only?  Also the name of the IE suggests that this information is only “for SCG”. Would that mean (e.g. in case of NE-DC), where MN may be the main contributor of overheating that the passed information does not concern MN and only E-UTRAN carriers should be reduced? |
| NTT DOCOMO | We agree with Nokia that backward compatibility must be ensured. So, when the new IE (container) is present, the legacy field has to indicate the MCG overheating information (i.e. reducedCCsDL and reducedCCsUL). Otherwise, the legacy field indicates the MCG + SCG overheating information. That principle must be kept.  With regards to utilising SRB3, this would also impact the LTE side. If SRB3 is used, the LTE overeating information has to represent the MCG overheating information. Nevertheless, the eNB has no idea whether the legacy field represents MCG only overheating or MCG + SCG overheating. This is because the MN (eNB) does not know if NR overheating information is delivered to gNB via SRB3 or not. |
| vivo | We are fine with the CR.  We are also OK to further clarify the overheating information for MCG or MCG+SCG, if the overheatingAssistanceForSCG is reported by SRB3. |
| Ericsson | We think SRB3 was already discussed and not agreed. On backwards compatibility aspect, indeed it should be ensured – the rapporteur proposal seems sufficient to ensure that. Basically, a legacy NW should already take its decision on e.g. release/deactivate carriers considering reducedCCsDL/UL as comprising both MN and SN SCells (and PSCell). Therefore, taking the example from Nokia above, the MN behavior would have to have a different behavior depending on whether overheatingAssistanceForSCG is present or not. Therefore, the proposed NOTE would guarantee that the MN behavior is always the same and reducedCCsDL/UL is not included in the SCG container when it relates to MN as well, but coordinated between MN and SN in inter-node messages. |
| CATT | Agree with the above change. Share the same view with Ericsson. |
| ZTE | Although we are in favor of SRB3 approach, we agree with others this was discussed and not agreed in RAN2.  But regarding the backwards compatibility issue, we have different understanding from Nokia/Docomo. Considering we have introduced UE capability and network control mechanism. When network enables R16 switch (i.e. overheatingAssistanceConfigForSCG-r16”), the UE is expected to behave as Rel-16 specification. So if UE does not report new field (i.e. overheatingAssistanceForSCG), shouldn’t it be interpreted as the UE does not want to change the configuration over SCG? It seems not reasonable for UE to fallback to legacy behaviour when UE supports R16 capability and R16 switch is set to ‘true’.  So in our view, the backwards compatibility is ensured by:   * Scenario1: If Rel-16 OverheatingAssistanceConfigForSCG Ind is not configured (Legacy behaviour) * Legacy field indicates overheating information for MCG+SCG; * New field is not present. * Scenario2: If Rel-16 OverheatingAssistanceConfigForSCG Ind is configured (which can only be configured in case the UE supports Rel16 behaviour) * Legacy field indicates overheating information for MCG; * New field indicates overheating information for SCG. |
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### 2.2 Coordination between MN and SN based on overheating assistance information in (NG)EN-DC and NR-DC

For the inter-node message (based on feedbacks in previous RAN2 meeting, majority of companies prefer to focus on (NG)EN-DC case and NR-DC case):

1. In (NG)EN-DC, if UE reports existing field *reducedCCsDL/UL*, MN transfers the maximum number of PSCells/SCells that SN is allowed to configure for the UE to the SN.
2. In NR-DC, if UE reports field *reducedCCsDL/UL, reducedBW-FR1/FR2-DL/UL* or *reducedMIMO-LayersFR1/FR2-DL/UL*, MN transfers the maximum number of PSCells/SCells, maximum aggregated bandwidth or maximum number of MIMO layers that SN is allowed to configure for the UE to the SN.

The associated main changes in TS 38.331 are given below.

ConfigRestrictInfoSCG ::= SEQUENCE {

*[omitted]*

]],

[[

overheatingAssistanceSCG OverheatingAssistance OPTIONAL,

allowedreducedMaxCCs-r16 SEQUENCE {

reducedCCsDL-r16 INTEGER (0..31),

reducedCCsUL-r16 INTEGER (0..31)

} OPTIONAL,

allowedreducedMaxBW-FR1-r16 SEQUENCE {

reducedBW-FR1-DL-r16 ReducedAggregatedBandwidth,

reducedBW-FR1-UL-r16 ReducedAggregatedBandwidth

} OPTIONAL,

allowedreducedMaxBW-FR2-r16 SEQUENCE {

reducedBW-FR2-DL-r16 ReducedAggregatedBandwidth,

reducedBW-FR2-UL-r16 ReducedAggregatedBandwidth

} OPTIONAL,

allowedreducedMaxMIMO-LayersFR1-r16 SEQUENCE {

reducedMIMO-LayersFR1-DL-r16 MIMO-LayersDL,

reducedMIMO-LayersFR1-UL-r16 MIMO-LayersUL

} OPTIONAL,

allowedreducedMaxMIMO-LayersFR2-r16 SEQUENCE {

reducedMIMO-LayersFR2-DL-r16 MIMO-LayersDL,

reducedMIMO-LayersFR2-UL-r16 MIMO-LayersUL

} OPTIONAL

]]

}

|  |
| --- |
| ***allowedreducedMaxCCs***  Indicates the maximum number of downlink/uplink PSCell/SCells that the SCG is allowed to configure. |
| ***allowedreducedMaxBW-FR1***  Indicates the maximum aggregated bandwidth across all downlink/uplink carriers of FR1 that the SCG is allowed to configure. This field is only used in NR-DC. |
| ***allowedreducedMaxBW-FR2***  Indicates the maximum aggregated bandwidth across all downlink/uplink carriers of FR2 that the SCG is allowed to configure. This field is only used in NR-DC. |
| ***allowedreducedMaxMIMO-LayersFR1***  Indicates the maximum number of downlink/uplink MIMO layers of each serving cell operating on FR1 that the SCG is allowed to configure. This field is only used in NR-DC. |
| ***allowedreducedMaxMIMO-LayersFR2***  Indicates the maximum number of downlink/uplink MIMO layers of each serving cell operating on FR2 that the SCG is allowed to configure. This field is only used in NR-DC. |

**2.2 Companies are encouraged to provide the comments for the analyses and changes in CR above.**

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| --- | --- |
| Company | Comments |
| OPPO | For my understanding, the overheatingAssistanceSCG here means to forward this information from MN to SN via inter-node message.  I am confused about other changes. Why we need this part? |
| Google | The UE indicates its preference in the *overheatingAssistanceForSCG*. We don’t think that the MN needs to overwrite the UE’s preference by other changes (i.e., *allowedreducedMaxCCs, allowedreducedMaxBW-FR1*…). It is sufficient to only forward the *overheatingAssistanceForSCG* to the SN. If the MN needs to restrict the SN configuration, the MN can always use the existing fields in *ConfigRestrictInfoSC*G. |
| BT | We prefer the network may solve any overheating problem instead the UE as suggested in NOTE 5 of R2-2003467. See our comments in 2.5 for further details. |
| Nokia, Nokia Shanghai Bell | We need to understand the meaning of the new field signalled by the UE vs. the legacy one. Knowing that we can look at the information that is transferred to the SN |
| NTT DOCOMO | Since NR overheating information encapsulated in LTE overheating message only concerns NR information, why not just forwarding the encapsulated meassage to SN? |
| vivo | First, MN needs to forward the *overheatingAssistanceForSCG* to the SN.  For other information, we are also trying to understand the intention. Whether these are introduced for MN to control the SN configuration by considering the UE assistance information? |
| Ericsson | a) is definitely needed concerning legacy overheating behavior, i.e. reducedCCsDL/UL corresponds to both MN and SN SCells (and PSCell).  It should also be noted that, for NR-DC, there is no need for an *overheatingAssistanceSCG* since both MN and SN are NR nodes. Hence, the report that the MN gets from the UE (as defined per Rel-15 overheating in NR), the MN can judge on whether to e.g. release/deactivate MN SCells based on it and further coordinate with the SN. Note that the container overheatingAssistanceSCG is only needed for EN-DC case because the MN is E-UTRA and it is thus not mandated to understand the NR configuration. |
| CATT | Agree with the above analyses. To make it more clear, we need also to clarify and add the corresponding field description for overheatingAssistanceForSCG: In (NG)EN-DC, if UE reports overheatingAssistanceForSCG, the MN transfers the received container to the SN. |
| ZTE | For a), we agree, and the “overheatingAssistanceSCG“ field is only used in case of (NG)EN-DC.  For b), this is applicable to NR-DC, we are not sure if this has been discussed in RAN2 before? But seems the proposed way is workable (i.e. let MN to decide the maximum number of CCs/BW/MIMO layers that SN is allowed to configure to UE).  Some comments on the ASN.1 aspect:  # For corrections on a)#   1. The definition of overheatingAssistanceSCG should be changed as below, because it is encoded by UE when transmitting in LTE UEAssistanceInformation message:   overheatingAssistanceSCG OCTET STRING (CONTAINING OverheatingAssistance) OPTIONAL,   1. The field description of overheatingAssistanceSCG is missing, indicating this is only used in (NG)EN-DC. 2. OverheatingAssitance structure is invoked in both LTE and NR spec, we suggest to use a separate section to capture this information element.   # For corrections on b)# (if companies agree the solution for NR-DC)   1. UE understand the intention of listing all individual fields is to emphasize these are use to indicated the “allowed” SCG configuration, not simple forwarding. But we think it is cleaner to refer to IE OverheatingAssistance, because the fields are the same. We can highlight in field description about the purpose instead of listing all detail fields. See below example:   overheatingAssistanceSCG OCTET STRING (CONTAINING OverheatingAssistance);  overheatingAssistanceNRDC OverheatingAssistance; |

### 2.3 UE capability for overheating assistance information for SCG

Introduce a new UE capability in LTE capability container for the new field (i.e. overheating assistance for SCG) in LTE UAI message.

The associated main changes in TS 36.331 are given below.

Other-Parameters-v16xy ::= SEQUENCE {

ce-RRC-INACTIVE-r16 ENUMERATED {supported} OPTIONAL,

overheatingIndForSCG-r16 ENUMERATED {supported} OPTIONAL}

|  |  |
| --- | --- |
| ***overheatingIndForSCG***  Indicates whether the UE supports overheating assistance information for SCG. | No |

In addition to the change in TS 36.331 for the new UE capability, the TS 36.306 needs update accordingly. We give the potential changes in TS 36.306 below, and if the changes can be agreed, we will prepare the 36.306 CR.

4.3.15.x *overheatingIndForSCG-r16*

This parameter defines whether the UE supports overheating assistance information for SCG as specified in TS 36.331 [5].

**2.3 Companies are encouraged to provide the comments for the analyses and changes in CR above.**

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| --- | --- |
| Company | Comments |
| OPPO | OK |
| Google | The changes look OK. |
| BT | OK |
| Nokia, Nokia Shanghai Bell | Capability is ok, but we need to have better understanding what it does imply in context of the legacy fields |
| NTT DOCOMO | Agree with Nokia |
| vivo | We are fine with this change. |
| Ericsson | This is ok. We think there would be no impact to legacy since the newly introduce SCG report would only be reported by the UE upon NW configuration as shown in section 2.4 below. |
| CATT | OK |
| ZTE | OK |

### 2.4 NW configuration for overheating assistance information for SCG

Based on the UE capability, MN determines the configuration for overheating assistance information for SCG. The UE is allowed to report the overheating assistance information for SCG if MN configures UE to do so.

The associated main changes in TS 36.331 are given below.

[[ overheatingAssistanceConfigForSCG-r16 CHOICE{

release NULL,

setup SEQUENCE{

overheatingProhibitTimerForSCG-r16 ENUMERATED {s0, s0dot5, s1, s2, s5, s10,

s20, s30, s60, s90, s120, s300, s600,

spare3, spare2, spare1}

}

} OPTIONAL -- Need ON

]]

|  |
| --- |
| ***overheatingAssistanceConfig***  Configuration for the UE to report assistance information to inform the eNB about UE detected internal overheating. |
| ***overheatingAssistanceConfigForSCG***  Configuration for the UE to report assistance information for SCG to inform the eNB and SN gNB about UE detected internal overheating. |
| ***overheatingIndicationProhibitTimer***  Prohibit timer for overheating assistance information reporting. Value in seconds. Value s0 means prohibit timer is set to 0 seconds, value s0dot5 means prohibit timer is set to 0.5 second, value s1 means prohibit timer is set to 1 second and so on. |
| ***overheatingIndicationProhibitTimerForSCG***  Prohibit timer for overheating assistance information reporting for SCG. Value in seconds. Value s0 means prohibit timer is set to 0 seconds, value s0dot5 means prohibit timer is set to 0.5 second, value s1 means prohibit timer is set to 1 second and so on. |

**2.4 Companies are encouraged to provide the comments for the analyses and changes in CR above.**

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| --- | --- |
| Company | Comments |
| OPPO | For my understanding, this part will be configured in otherConfig in LTE spec to enable the SCG overheating.  The overheating is support in NR and the otherConfig in NR RRCConfiguration can configure the overheating parameters. I wonder if the NR RRCConfiguration can configure the otherconfig for overheating configuration if the NR RRCReconfiguration message is SCG NR message? if so, how to handle this case in UE side?  Copy from 38.331:  OtherConfig-v1540 ::= SEQUENCE {  overheatingAssistanceConfig SetupRelease {OverheatingAssistanceConfig} OPTIONAL, -- Need M  ...,  [[  idc-AssistanceConfig-r16 SetupRelease {IDC-AssistanceConfig-r16} OPTIONAL, -- Need M  btNameList-r16 BT-NameListConfig-r16 OPTIONAL, -- Need N  wlanNameList-r16 WLAN-NameListConfig-r16 OPTIONAL, -- Need N  sensorNameList-r16 Sensor-NameListConfig-r16 OPTIONAL, -- Need N  obtainLocationConfig-r16 ObtainLocationConfig-r16 OPTIONAL, -- Need N  sl-AssistanceConfigEUTRA-r16 ENUMERATED {true} OPTIONAL, -- Need R  sl-AssistanceConfigNR-r16 ENUMERATED {true} OPTIONAL -- Need R  ]]  } |
| Google | The changes look OK. |
| Nokia, Nokia Shanghai Bell | Our understanding was the IE is passed to MN only: ~~and SN gNB~~  “For SCG” is also requiring discussion, as our thinking was the field may include both: MN +SN information in case the legacy field is not present |
| NTT DOCOMO | We think that the configuration comes together with the legacy one, since the legacy field is also utilised. In that sense, the configuration is an extension of the legacy field. |
| vivo | We are fine with this change. |
| Ericsson | Agree with Docomo. |
| CATT | Agree with the change. |
| ZTE | We actually understand the new configuration can replace the legacy configuration. Otherwise, if network configures two different prohibit timer values, how does UE perform the reporting procedure and generate the reporting information? Sometimes the “overheatingAssistanceForSCG” is included, sometimes it is not included? |

### 2.5 Other

**2.5 Companies are encouraged to provide any other comments for the CRs R2-2003467/R2-2003468.**

|  |  |
| --- | --- |
| Company | Comments |
| Google | We think a MN-SN coordination is needed for the MN to know the SN supports *overheatingAssistanceForSCG*. |
| BT | * In R2-2003467, 5.6.10.3. It looks to us that *overheatingAssistanceForSCG* is always included once is initiated in 5.6.10.2. For LTE in ENDC, there are additional conditions that prevents the UE to send such information if it no longer experiences an overheating condition.  |  | | --- | | 1. if configured to provide overheating assistance indication for SCG: 2. if the UE experiences internal overheating:   3> include and set *overheatingAssistanceForSCG* in accordance with TS 38.331 [82], clause 5.7.4.3; |  * In NOTE 5 in R2-2003467, the decision to reduce the max number of CC is left to UE implementation but we prefer this decision on the network side. We propose two alternatives.   + Alt-1: allow the UE to report the required reduction in LTE and the required reduction in NR to solve overheating being the network who takes the final decision.   + Alt-2: the network notifies if the UE shall prioritize LTE or NR for ENDC. * Agree with Google comments about MN-SN coordination. |
| Nokia, Nokia Shanghai Bell | Section 5.3.10.9, already includes procedures to instruct the UE is configured for overheating assistance information (legacy one). The newly added procedures should distinguish the configuration is setup (or released) for provision of the new/extended contents |
| Ericsson | On the comments about MN-SN coordination for the MN to know the SN supports *overheatingAssistanceForSCG*, we think this is not different from other cases where MN may support a feature and SN does not support it. Such cases have anyway to be settled statically between MN and SN and do not require inter-node messages.  Another aspect is that we agree with the NOTE 5, but since this is a normative text that should be followed, it could not be kept in the note. Therefore one could consider to add something as below for 36.331 field description:  “In EN-DC, this field is not included when overheatingAssistanceForSCG is included with indication of UE preference to temporarily reduce the number of maximum secondary component carriers as specified in 38.331”.  And a similar description in 38.331:  “In EN-DC, this field is not included when E-UTRA OverheatingAssistance IE contains UE preference to temporarily reduce the number of maximum secondary component carriers as specified in 36.331”. |
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## 3 Conclusions

[To be updated]