3GPP TSG-RAN WG2 Meeting #110-e R2-200xxxx

Electronic, 1 – 12 June 2020

Agenda: 6.20.1.1

Source: Huawei, HiSilicon

Title: Report for [Post109bis-e][050][TEI16] Overheating

Document for: Discussion and Decision

# 1 Introduction

This document contains a list of documents to be discussed for the email discussion below.

* [Post109bis-e][050][TEI16] Overheating (Huawei)

Scope: Continue the discussion in AT109bis-e [050], pave the way for agreements  
Intended Outcome: Report  
Deadline: Next Meeting

# 2 Discussion

## 2.1 Summary for the offline discussion in RAN2#109bis-e

Based on the offline discussion [AT109bis-e][050][TEI16] Overheating (please see Appendix), there were some consensuses, and the summaries and proposed conclusions are provided below. As there are still some comments (I understand comments are mainly related to the wording of the conclusion), I try to clarify a bit more for the proposed conclusions.

* Rel-16 new overheating IEs in (NG)EN-DC is introduced including: reducedCCsDL/UL, reducedBW-FR1/FR2-DL/UL, reducedMIMO-LayersFR1/FR2-DL/UL (encapsulated information). If UE reports this Rel-16 new field in (NG)EN-DC, it is interpreted as only for SCG. No MN-SN coordination on reduced configuration is needed, MN forwards this encapsulated information to the SN.

There are following proposed conclusions:

**Proposal 1: In (NG)EN-DC, the new field for overheating assistance information refers to the NR *OverheatingAssistance* IE as specified in TS 38.331.**

**Proposal 2: In (NG)EN-DC, if the new field for NR overheating assistance information encapsulated in LTE message is reported by the UE, the MN forwards this encapsulated information to the SN.**

* For Rel-15 legacy overheating IEs in (NG)EN-DC (including reducedCCsDL/UL), if UE reports it in (NG)EN-DC, it should be interpreted as for both MCG and SCG in the MN. To support the MN-SN coordination on reduced configuration in Rel-16, MN needs to be able to indicate the maximum number of PSCell/SCells that the SCG is allowed to configure to the SN.
* For Rel-15 legacy overheating IEs in NR-DC (including reducedCCsDL/UL, reducedBW-FR1/FR2-DL/UL, reducedMIMO-LayersFR1/FR2-DL/UL), if UE reports it in NR-DC, it should be interpreted as for both MCG and SCG in the MN. To support the MN-SN coordination on reduced configuration in Rel-16, MN needs to be able to indicate the maximum number of PSCell/SCells that the SCG is allowed to configure, maximum aggregated BW that the SCG is allowed to configure and the maximum number of MIMO layers that the SCG is allowed to configure to the SN.

There are following proposed conclusions:

**Proposal 3: For Rel-15 legacy overheating IEs, the *reducedCCsDL/UL* (for (NG)EN-DC and NR-DC), *reducedBW-FR1/FR2-DL/UL* (for NR-DC) or *reducedMIMO-LayersFR1/FR2-DL/UL* (for NR-DC) are interpreted as for both MCG and SCG, the MN can indicate the allowed CC/BW/MIMO to the SN for coordination on reduced configuration.**

**Proposal 4: In (NG)EN-DC, the interpretation for the Rel-15 legacy overheating IE (i.e. *reducedCCsDL/UL*) is not changed, i.e. it is always interpreted as the preference for both MCG and SCG.**

* UE capability for overheating assistance information for SCG

**Proposal 5: In (NG)EN-DC, introduce a new UE capability in LTE capability container for the new field (i.e. overheating assistance information for SCG) in LTE assistance information message.**

* NW configuration for overheating assistance information for SCG

**Proposal 6: In (NG)EN-DC, MN determines the configuration for overheating assistance information for SCG. The configuration for the new overheating IE comes together with the configuration for the legacy overheating IE.**

#### **Q1. Please companies confirm the above six proposals.**

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| Company | Comments |
| MediaTek | In general fine with P1 to P5.  For P6, first part is OK, the feature should be enabled/disabled by NW. We are not sure why the second sentence is needed. Is it possible that overheating reporting is just reported for SCG in (NG)EN-DC? As the intention of this feature is that NR SCG parts may be the main contribution factor on overheating, it may be make senses that the NW only enabled the SCG overheating reporting and MN simply forward the content to the SN.  [Rapporteur]: the intention of the second sentence is that companies understand the new overheating reporting for SCG is the additional function based on the legacy overheating mechanism. Thus, the NW supporting legacy overheating mechanism would further enable the new overheating reporting. For your question “Is it possible that overheating reporting is just reported for SCG in (NG)EN-DC?” I understand it is still possible. Although the configuration for legacy reporting and new reporting come together, how to trigger the reporting and set the content in overheating IE is up to UE implementation. It is allowed that UE only reports overheating assistance info for SCG if NR SCG parts is the main contributor. |
| Ericsson | The proposals above are, in general, fine to us. On the comment from Mediatek, our understanding is that if the overheating issue is solely associated to the SCG (even though the NW configured the overheating for both MCG and SCG), the UE could still report it and the MN would thus forward this to the SN. |
| NTT DOCOMO | Proposal 1, 2, 5 and 6 are fine. On the other hand, Proposal 3 and 4 are worth to discuss what the legacy behaviour is. There are two UE behaviours defined so far:  1) UE behaviour for LTE standalone  2) UE behaviour for EN-DC  For 1), the UE reports reducedCCsDL/UL for LTE CCs, whilst for 2), the UE reports reducedCCsDL/UL for both LTE MCG and NR SCG. Given that SN can learn the SCG part of reducedCCsDL/UL via NR OverheatingAssistance IE. what MN needs to learn is its own reduced CCs. In that sense, The legacy behaviour for LTE standalone is enough. Due to the fact that both legacy behaviours have been defined and implemented, behaviour 1) can also be a viable approach just to report the minimum information required by NW.  [Rapporteur]: not sure if I catch the point. I understand the case 1) and case 2) won’t exist simultaneously. For the Rel-15 legacy overheating IEs i.e. reducedCCsDL/UL, if the UE is working on the LTE standalone, then the eNB interprets the reported reducedCCsDL/UL as the preferred number of SCells; if the UE is working on the EN-DC, then the **MN** eNB interprets the reported reducedCCsDL/UL as the preferred number of SCells **across MCG and SCG**. It means the interpretation for the same IE would be different based on the current architecture.  Thus, there are no impacts on the LTE standalone since the enhanced solution for UE reporting in TEI16 is about (NG)EN-DC. For (NG)EN-DC:   1. if only Rel-15 legacy overheating IE i.e. reducedCCsDL/UL is reported, the legacy behavior is not changed; 2. if only Rel-16 new overheating IE (for SCG) is reported, the new behavior is that MN forwards this encapsulated information to the SN; 3. if both Rel-15 legacy and Rel-16 new overheating IE i.e. reducedCCsDL/UL is reported, one possible behavior is as mentioned above that “Given that SN can learn the SCG part of reducedCCsDL/UL via NR OverheatingAssistance IE. what MN needs to learn is its own reduced CCs.” It is one of the possible implementation. In this case, it goes to Q2.   There is one point I would like to clarify, in our understanding, although the configuration for legacy reporting and new reporting come together, how to trigger the reporting and set the content in overheating IE is up to UE implementation. It is allowed that UE only reports overheating assistance info for SCG if NR SCG parts is the main contributor.  My point was that MN is enough to learn the preferred number of SCells in MCG only. This is because the SCG part of preferred number of SCells is conveyed to SN via the new IE reported from the UE.  [Rapporteur]: agree above. |
| Nokia | Small suggestion for rewording P1:  In (NG)EN-DC, the new field for overheating assistance information **in LTE RRC (TS36.331)** refers to the NR *OverheatingAssistance* IE as specified in TS 38.331.  For P6 wording – it depends on how the Q3 will be resolved.We think that the requirement to always configure both may result in some practical issues. E.g. there is no requirement to the UE capabilities to support mandatory (Rel-14 and Rel-16) indicators. If fit happens, the UE does not support Rel-14 indication, it would unnecessarily limit possibilities to receive at least NR Assistance Information.  [Rapporteur]: the suggestion for rewording P1 looks good.  I agree the case mentioned above may happen, there are some limits that UE has to support legacy Rel-15 UE capability if UE wants to support R16 new overheating reporting. And if the NW would like to enable the R16 new overheating reporting, it enable the R15 overheating reporting simultaneously. Anyway it seems feasible. |
| QCOM | Proposal 1 to 5 are fine.  Just to make sure we have the right understanding for P6, legacy overheating configuration can be provided by itself (even if UE suports new IE), however if network decides to configure the new IE, legacy will be configured as well. The implication of this is that if UE supports new IE, UE shall support legacy as well. If this is the case, than we’re fine with P6  [Rapporteur]: The understanding above is exactly the intention of P6. |
| Google | We are fine with P1-P2 and P4-P6. We wonder why P3 is needed.  In our understanding, the legacy MN already can kind of restrict CC/BW/MIMO that SN can configure via the legacy inter-node signalling. We wonder P3 is just an optimization.  [Rapporteur]: in my understanding, in legacy field *CG-ConfigInfo*, no signalling (e.g. fields in ConfigRestrictInfoSCG) can support coordination for CC/BW/MIMO, so it is sessential signallling added in the inter-node message to achieve the MN-SN coordination. Please let me know if you have different views. |
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Summary:

P1 (8/8): a rewording for P1 is suggested by one company (Nokia). In Rapporteur’s understanding, it is wording improvement and can be accepted.

P2, P5 (8/8): all companies providing comments are fine with P2 and P5.

P3 (6/8): one company (DOCOMO) think the legacy behaviour needs to be discussed, please see Rapporteur’s reply above. One companies (Google) wonders if P3 is just an optimization, please see Rapporteur’s reply above.

P4 (7/8): one company (DOCOMO) think the legacy behaviour needs to be discussed, please see Rapporteur’s reply above.

P6 (7/8): one company (MediaTek) is not sure why the second sentence is needed, please see Rapporteur’s reply above. One company (Nokia) has some concerns on P6 wording which depends on how the Q3 will be resolved, please see Rapporteur’s reply above.

Based on the feedbacks, the majority of companies (at least 6/8) are fine with P1-P6 (P1 is re-worded). Thus, the following proposals are suggested:

**Proposal 1: In (NG)EN-DC, the new field for overheating assistance information in LTE RRC (TS36.331) refers to the NR *OverheatingAssistance* IE as specified in TS 38.331.**

**Proposal 2: In (NG)EN-DC, if the new field for NR overheating assistance information encapsulated in LTE message is reported by the UE, the MN forwards this encapsulated information to the SN.**

**Proposal 3: For Rel-15 legacy overheating IEs, the *reducedCCsDL/UL* (for (NG)EN-DC and NR-DC), *reducedBW-FR1/FR2-DL/UL* (for NR-DC) or *reducedMIMO-LayersFR1/FR2-DL/UL* (for NR-DC) are interpreted as for both MCG and SCG, the MN can indicate the allowed CC/BW/MIMO to the SN for coordination on reduced configuration.**

**Proposal 4: In (NG)EN-DC, the interpretation for the Rel-15 legacy overheating IE (i.e. *reducedCCsDL/UL*) is not changed, i.e. it is always interpreted as the preference for both MCG and SCG.**

**Proposal 5: In (NG)EN-DC, introduce a new UE capability in LTE capability container for the new field (i.e. overheating assistance information for SCG) in LTE assistance information message.**

**Proposal 6: In (NG)EN-DC, MN determines the configuration for overheating assistance information for SCG. The configuration for the new overheating IE comes together with the configuration for the legacy overheating IE.**

## 2.2 Remaining open issues

### 2.2.1 For Rel-16 new overheating IEs in (NG)EN-DC, the handling of reducedMaxCC

Rel-16 new overheating IEs in (NG)EN-DC is introduced including: reducedCCsDL/UL, reducedBW-FR1/FR2-DL/UL, reducedMIMO-LayersFR1/FR2-DL/UL, and it is interpreted as only for SCG. Besides, Rel-15 legacy overheating IE includes reducedCCsDL/UL as well, and it is interpreted as for both MCG and SCG. Thus, reducedMaxCC is a special IE that can be included in legacy overheating IE and the new overheating IE. There are several ways to handle reducedMaxCC:

1. UE is restricted not to include reducedMaxCCs in both legacy overheating IE (overheatingAssistance-r14) and new overheating IE (overheatingAssistanceForSCG-r16) simultaneously, as the NOTE 5 presents in current draft CRs.
2. reducedMaxCCs is excluded from the new overheating IE (overheatingAssistanceForSCG-r16). If it is agreed, the restriction should be captured in the spec.
3. UE can report reducedMaxCCs in both legacy overheating IE (overheatingAssistance-r14) and new overheating IE (overheatingAssistanceForSCG-r16), reducedMaxCCs in legacy IE is intended for MCG+SCG, reducedMaxCCs in new IE is intended for only SCG. If it is agreed, there are no impacts on the spec.

#### **Q2. Companies are encouraged to provide the views on the above Alt 1), Alt 2) and Alt 3). If Alt 1) or Alt 2) is selected, how to capture the restriction in the spec (e.g. adding a NOTE or text in the field description)?**

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| Company | Comments |
| MediaTek | Prefer Alt-3  As explained by the rappoerteur, the two fields have different meaning   * In new Rel-16 IE - it is interpreted as only for SCG * In legacy IE - it is interpreted as for both MCG and SCG   We do not understand why the UE cannot include the complete information to the Network. It is of course up to MN to use the information or not. Thus we think that Alt-1 is not reasonable.  Alt-2 viloates the intention to have SCG over heating information and thus is not preferable.  We may have to discuss whether a new filed reported **for MCG only** is needed while SCG over heating information is included. We are open for that. |
| Ericsson | Alt 1), we think in this case there is no legacy impact for overheating framework. Furthermore, in this case, if the overheating issue is only related to the SCG, the UE could still include this report in the overheatingAssistanceForSCG-r16. |
| NTT DOCOMO | Alt.3 together with the approach commented to Q1. Given that information required for MN and SN is delivered via separate IE in the UE assitance information, both the legacy and new IE have to be present. |
| Nokia | Alt-3 |
| QCOM | We prefer Alt#3 |
| Samsung | Alt-3 |
| Huawei | Alt-3 is ok. If reducedMaxCCs is reported in both legacy overheating IE and new overheating IE, it means UE has clear requirement for the number of sCC for SCG, and the total number of sCC for MCG+SCG. But anyway, it is up to NW implementation on how to adjust the configuration in MN side and in SN side. |
| Google | Alt-3 |
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Summary:

One company (Ericsson) think Alt 1) has no legacy impact for overheating framework. In Rapporteur’s understanding, as the NW configures the UE with new overheating assistance reporting, the NW is the upgraded NW and can support new behaviour. If reducedMaxCCs is reported in both legacy overheating IE and new overheating IE, it is still up to NW implementation on how to adjust the configuration in MN side and in SN side.

Based on the feedbacks, the majority of companies (7/8) are fine with Alt-3. Thus, the following proposal is suggested:

**Proposal 7: UE can report *reducedMaxCCs* in both legacy overheating IE (overheatingAssistance-r14) and new overheating IE (overheatingAssistanceForSCG-r16), *reducedMaxCCs* in legacy IE is intended for MCG+SCG, *reducedMaxCCs* in new IE is intended for only SCG.**

### 2.2.2 MN-SN coordination

As raised by Google/BT, the MN needs to know whether the SN supports new field overheatingAssistanceForSCG. It seems beneficial that the SN can indicate the preference for enabling the SCG specific overheating assistance information reporting. Considering that the SCG specific UAI is mainly used by the SN, if the SN has no expectation of receiving SCG specific overheating assistance information or adjusting the SN configuration for the UE based on overheating assistance, actually the UE should not be allowed to report SCG specific UAI, otherwise it leads to unnecessary signalling overhead and resources wastes.

Thus, in (NG)EN-DC, the SN can indicate if it supports and prefers to enable the reporting of new field overheatingAssistanceForSCG, the MN considers the preference from the SN and makes the final decision, i.e. configures UE whether it is allowed to report new field overheatingAssistanceForSCG.

#### **Q3. Companies are encouraged to provide the views for above proposal.**

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| Company | Comments |
| MediaTek | Seems reasonable to let SN suggest whehter to enable the overheating infroamtion reporting for SCG. |
| Ericsson | In short we do not see a need for this coordination, please refer to our comments as provided in sections 2.5 and 3.3 from the Appendix. |
| NTT DOCOMO | Agree with Ericsson. It is just the same handling where one node supports a feature, but the other node does not. If SN does not support this extension, or SN does not wish to handle overheating in SCG, SN just ignore the overheating assistance IE forwarded from MN. Even for intra-vendor deployment, this approach anyway works and so the additional coordination between MN and SN is not essential. |
| Nokia | Overall, it should be MN controlled mechanism, SN preferences may be not thet meaningful |
| QCOM | UE transmitting overheating reports that is not considered by the SN because SN doesn’t support this feature, is system inefficient and goes against the intention of the feature (reduce heat).  Based on this, MN should be aware of the SN capaiblity in supporting this feature, however, it’s up to network implemenation on how to handle it |
| Samsung | SN could simply indicate its support by OAM, if required. We wonder why we need to introduce UE specific inter-node signalling, i.e. would SN really have different preferene for different UEs? It seems too much enhancement. |
| Huawei | No strong view. Agree that it works even if no such coordination, anyway the SN can ignore the reported overheating assistance info, although it may waste some radio resources. |
| Google | Considering inter-vendor scenario, we prefer to have a standardized way to coordniate MN and SN rather than by O&M. |
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Summary:

Three companies (MediaTek, Qualcomm, Google) think it is reasonable to let SN suggest whether to enable the new overheating information reporting for SCG. Five companies (Ericsson, DOCOMO, Nokia, Samsung, Huawei) understand it is not an essential problem. In Rapporteur’s understanding, it is an enhancement and considering it is a topic in TEI16, a simplified solution is preferred.

Based on the feedbacks, the majority of companies (5/8) think the MN-SN coordination for SN capability/preference on new overheating assistance information for SCG is not needed. Thus, the following proposal is suggested:

**Proposal 8: SN indicating/suggesting whether to enable the new overheating information reporting for SCG is not supported in TEI16.**

As raised by Qualcomm, NR SCG usually consumes more power than LTE MCG. The gNB has better understanding than the eNB on how to save UE power consumption in NR. The SN is able to send proposed value of reducedMaxCCs in CG-Config to the MN. Similarly, to enable the SN negotiation with the MN for the shared overheating parameters in NR-DC, the SN is able to send proposed value of reducedMaxBW and reducedMaxMIMO-Layers in CG-Config to the MN.

#### **Q4. Companies are encouraged to provide the views for above proposal.**

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| Company | Comments |
| MediaTek | No strong view. But it seems additional enhacement. We should not spend too much time on this. |
| Ericsson | In short we do not see a benetif of this approach, please refer to our comments as provided in question 3.3-2 in section 3.3 from the Appendix. |
| NTT DOCOMO | As overheating is an urgent situation that UE needs to be reconfigured with reducing CCs, Bandwidth and MIMO layers, it is unrealistic that MN and SN negotiate and try to optimise the configurations between MCG and SCG. It is likely that NW reconfigures as reported by the UE. |
| Nokia | Overall, it should be MN controlled mechanism, SN preferences bring additional complexity |
| QCOM | The suggested coordination between MN and SN is optional, i.e. MN may or may not wait for the SN reponse, where MN can go ahead and configure the UE accordingly. The SN response is considered as a fine tuning for the MN configuration.  Our request is motivated by the fact that SN is more aware of the source of heat at the UE and on how it can be reduced.  Regarding the time sensitivity/urgency of reporting the Overheating assistance information, it’s in the order of seconds, therefore plenty of time is available for MN-SN coordination. |
| Samsung | MN decides based on the legacy fields, and SN needs to act based on configuration restrictions provided by MN.  With the new EN-DC overheating solution, SN can additionally reduce power based on the new field that MN transparently forwards. We don’t think the intention is that MN would subsequently change the overall power control pameters i.e. it should stick to what it decided based on the legacy fields. So no need for MN to know what SN really did. Note that MN already receives the selectedBandEntriesMNList, see below for details (selected BC and feature sets). Anyhow, no further signalling/ enhancement seems needed. |
| Huawei | No strong view. |
| Google | We don’t see a need to have this optimization |
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Summary:

One company (Qualcomm) thinks the SN should be able to send proposed value of reducedMaxCCs in CG-Config to the MN. Seven companies (MediaTek, Ericsson, DOCOMO, Nokia, Samsung, Huawei, Google) understand it is not essential problem. In Rapporteur’s understanding, it is an enhancement and considering it is a topic in TEI16, a simplified solution is preferred.

Based on the feedbacks, the majority of companies (7/8) think the MN-SN coordination for SN proposed value of reducedMaxCCs in CG-Config is not needed. Thus, the following proposal is suggested:

**Proposal 9: SN proposed value of reducedMaxCCs in CG-Config is not supported in TEI16.**

### 2.2.3 UE capability for new overheating IE in (NG)EN-DC

In Rel-15, there is a LTE capability *overheatingInd* indicating whether the UE supports overheating assistance information. And a new UE capability in LTE capability container for the new field (i.e. overheating assistance information for SCG) in LTE assistance information message is introduced, e.g. *overheatingIndForSCG*.

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| ***overheatingInd***  Indicates whether the UE supports overheating assistance information. | No |
| ***overheatingIndForSCG***  Indicates whether the UE supports overheating assistance information for SCG in (NG)EN-DC. | No |

There is a understanding that Rel-16 enhanced overheating reporting is an addition to the legacy Rel-15 behaviour and thus the UE would have to at least support the legacy overheating behaviour if it would want to support Rel-16 behaviour. The configuration for the new overheating IE comes together with the configuration for the legacy overheating IE.

Thus, there is a relationship between legacy Rel-15 UE capability and new Rel-16 UE capability, i.e. the UE supporting overheating assistance information for SCG should include the *overheatingInd*.

#### **Q5. Companies are encouraged to provide the views for above proposal, and whether anything needs to be captured in the spec.**

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| Company | Comments |
| MediaTek | First we think it is reasonable to have R16 capability for overheating report of SCG.  We are fine to say that a UE supports R16 overheating report of SCG should also support overheating report of MCG.(No strong view)  For the configuration dependency, as our comment in Q1, it seems ok to enable SCG overheating report only. |
| Ericsson | We suggest to clarify the relation between the two fields as follows:  ***overheatingIndForSCG***  Indicates whether the UE supports including NR SCG information in overheating assistance information. The UE which indicates support of *overheatingIndForSCG* shall also indicate support of *overheatingInd*. |
| NTT DOCOMO | Agree with Ericsson. Support of overheatingInd should be a condition for a UE to support this extension mechanism. |
| Nokia | Agree that configuration dependency should be clarified. Ideally the assistance information should come together, but if there are two UE capabilities, it may be limiting to allow network configurtaion only in case two features support is indicated |
| Qcom | We’re fine |
| Samsung | If the configuration dependency is acceptable, the legacy and new capability have also dependency. |
| Huawei | Fine to clarify the relationship between legacy Rel-15 UE capability and new Rel-16 UE capability. |
| Google | We suggest to add “the UE supporting overheating assistance information for SCG should include the *overheatingInd*“ in field description of ***overheatingIndForSCG***. |
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Summary:

All company providing comments are fine with the clarification for the relationship between legacy Rel-15 UE capability and new Rel-16 UE capability, i.e. the UE supporting new overheating assistance information for SCG shall also indicate support of legacy *overheatingInd*.

Based on the feedbacks, all companies (8/8) providing comments think the clarification for the relationship is needed. Thus, the following proposal is suggested:

**Proposal 10: The UE supporting new overheating assistance information for SCG shall also indicate support of legacy *overheatingInd*.**

### 2.2.4 NW configuration for new overheating IE in (NG)EN-DC

The configuration for the new overheating IE comes together with the configuration for the legacy overheating IE. Thus, there are several ways to handle prohibit timer:

1. One shared prohibit timer. The reporting of new overheating field and legacy overheating field share one prohibit timer.

The example of ASN.1 design is given below.

[[ overheatingAssistanceConfig-r14 CHOICE{

release NULL,

setup SEQUENCE{

overheatingIndicationProhibitTimer-r14 ENUMERATED {s0, s0dot5, s1, s2, s5, s10,

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

spare3, spare2, spare1}

}

} OPTIONAL -- Need ON

]],

*Omitted…*

[[ overheatingAssistanceConfigForSCG-r16 ENUMERATED {enabled, disabled} OPTIONAL -- Cond overheating

]]

}

| **Conditional presence** | **Explanation** |
| --- | --- |
| *overheating* | The field is optionally present if *overheatingAssistanceConfig* is present, need ON. Otherwise the field is not present. |

1. Two separate prohibit timers. The reporting of new overheating field and legacy overheating field are controlled by two prohibit timers separately.

The example of ASN.1 design is given below.

[[ overheatingAssistanceConfig-r14 CHOICE{

release NULL,

setup SEQUENCE{

overheatingIndicationProhibitTimer-r14 ENUMERATED {s0, s0dot5, s1, s2, s5, s10,

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

spare3, spare2, spare1}

}

} OPTIONAL -- Need ON

]],

*Omitted…*

[[ 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 -- Cond overheating

]]

}

| **Conditional presence** | **Explanation** |
| --- | --- |
| *overheating* | The field is optionally present if *overheatingAssistanceConfig* is present, need ON. Otherwise the field is not present. |

#### **Q6. Companies are encouraged to provide the views on the above Alt 1) and Alt 2), and the comments for above ASN.1design.**

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| Company | Comments |
| MediaTek | We prefer to have 2 timer and independent control of R14 overheating reporting and R16 overheating report of SCG. In this way, the change is clear and provide full flexibility. Thus prefer Alt-2 but without the conditional code. |
| Ericsson | Alt 1) - It is not clear to us what would be the benefit to have two prohibit timers. On the particular approach shown above for Alt 1), we should have ways to release overheatingAssistanceConfigForSCG. So either we make overheatingAssistanceConfigForSCG with setup/release possibility, or we should make overheatingAssistanceConfig-r16 as the field to be configured **instead** of overheatingAssistanceConfig-r14, i.e. if the rel-16 field is configured it implies in both MCG and SCG (if configured) to be included in the overheating report. |
| NTT DOCOMO | Atl.1 We’d like to understand the technial rationale of haveing two different prohibit timer for MCG and SCG. Since it is an urgent scenario not for an power saving, there is no room to opimise the parameter. So, one common timer is sufficient to address the urgent scenario. In terms of ASN.1 for Alt.1, for such a case, BOOLEAN with need ON was used in the past.  [Rapporteur]: thanks for spotting this, BOOLEAN with need ON is correct! |
| Nokia | Agree with DOCOMO |
| Qcom | One timer should be enough, however not strong opinion |
| Samsung | Alt 1 |
| Huawei | Fine with Alt 1. |
| Google | One timer is sufficient so we prefer Alt. 1 |
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Summary:

One company (MediaTek) prefers to have 2 independent timer which provides full flexibility. Seven companies (Ericsson, DOCOMO, Nokia, Qualcomm, Samsung, Huawei, Google) understand one shared prohibit timer is enough. In Rapporteur’s understanding, one shared prohibit timer is feasible and considering it is a topic in TEI16, a simplified solution is preferred.

Based on the feedbacks, the majority of companies (7/8) think one shared prohibit timer is enough. Thus, the following proposal is suggested:

**Proposal 11: The reporting of new overheating field and legacy overheating field are controlled by one shared prohibit timer.**

### 2.2.5 Other open issues

#### **Q7. Please provide the comments not covered by above discussion if any.**

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| Company | Comments |
| QCOM | As you all know, this feature (overheating) somehow intersect with the power saving feature as both use almost the same fields, but different mechanism/messages to communicate with the network. maybe at a later stage we need to define the interaction of these features.  [Rapporteur]: it seems a more generic issue across different topics, I am open to discuss it at a later stage if there is anything needs clarification. |
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### 2.2.6 Comments on the draft CRs

The draft CRs are provided based on the reached consensus and needs update based on the outcome for this email discussion. Your comments on the current draft CRs are much appreciated.

#### **Q8. Please provide the comments for the draft CRs if any.**

|  |  |
| --- | --- |
| Company | Comments |
| MediaTek | How to set the content in the LTE container *overheatingAssistanceForSCG* (include the NR IE *OverheatingAssistance*)?  The way capture in current draft CR is inappropriate. We should have a new section in 38.331 (e.g. 5.7.4.3a Setting the contents of *OverheatingAssistance*) and the 36.331 should refer to this section on setting of the container. The NR 5.7.4.3 is used for transmission of NR *UEAssistanceInformation* message. It is not suitable to have LTE RRC refer to this section.  [Rapporteur]: thanks, I will consider it for draft CRs update. |
| Nokia | Cover Page should clarify what is „the legacy“ field,(is it the one existing in 36.331)  [Rapporteur]: thanks, I will consider it for draft CRs update. |
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# 3 Conclusion

Based on the feedbacks, the following proposals are suggested:

**Proposal 1 (8/8): In (NG)EN-DC, the new field for overheating assistance information in LTE RRC (TS36.331) refers to the NR *OverheatingAssistance* IE as specified in TS 38.331.**

**Proposal 2 (8/8): In (NG)EN-DC, if the new field for NR overheating assistance information encapsulated in LTE message is reported by the UE, the MN forwards this encapsulated information to the SN.**

**Proposal 3 (6/8): For Rel-15 legacy overheating IEs, the *reducedCCsDL/UL* (for (NG)EN-DC and NR-DC), *reducedBW-FR1/FR2-DL/UL* (for NR-DC) or *reducedMIMO-LayersFR1/FR2-DL/UL* (for NR-DC) are interpreted as for both MCG and SCG, the MN can indicate the allowed CC/BW/MIMO to the SN for coordination on reduced configuration.**

**Proposal 4 (7/8): In (NG)EN-DC, the interpretation for the Rel-15 legacy overheating IE (i.e. *reducedCCsDL/UL*) is not changed, i.e. it is always interpreted as the preference for both MCG and SCG.**

**Proposal 5 (8/8): In (NG)EN-DC, introduce a new UE capability in LTE capability container for the new field (i.e. overheating assistance information for SCG) in LTE assistance information message.**

**Proposal 6 (7/8): In (NG)EN-DC, MN determines the configuration for overheating assistance information for SCG. The configuration for the new overheating IE comes together with the configuration for the legacy overheating IE.**

**Proposal 7 (7/8): UE can report *reducedMaxCCs* in both legacy overheating IE (overheatingAssistance-r14) and new overheating IE (overheatingAssistanceForSCG-r16), *reducedMaxCCs* in legacy IE is intended for MCG+SCG, *reducedMaxCCs* in new IE is intended for only SCG.**

**Proposal 8 (5/8): SN indicating/suggesting whether to enable the new overheating information reporting for SCG is not supported in TEI16.**

**Proposal 9 (7/8): SN proposed value of reducedMaxCCs in CG-Config is not supported in TEI16.**

**Proposal 10 (8/8): The UE supporting new overheating assistance information for SCG shall also indicate support of legacy *overheatingInd*.**

**Proposal 11 (7/8): The reporting of new overheating field and legacy overheating field are controlled by one shared prohibit timer.**

# 4 Appendix

## 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 (phase 1)

### 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

}

|  |
| --- |
| ***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.**

|  |  |
| --- | --- |
| 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?  *[Rapporteur]: the overheatingAssistanceForSCG is added as the content of LTE UAI message, the overheatingAssistanceForSCG is visible to MN if the MN intends to comprehend the content. For SRB3, as some companies indicates, it was discussed and not agreed. So rapporteur kindly suggests to stick to our agreed way forward and focuses on stage3 issues.* |
| Google | The changes look OK. |
| BT | Agree with Oppo. Why is not possible to have both options, to MN as container and via SRB3?  *[Rapporteur]: please see the responses for OPPO’s comments above.* |
| 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?  *[Rapporteur]: agree not to re-open the discussion for SRB3.*  *For the NOTE, actually the intention is that if both legacy overheating reporting and new overheating reporting are enabled for a UE, it would be complex for the NW if UE reports reducedMaxCCs in both legacy IE (interpreted as MCG+SCG) and legacy IE (interpreted as SCG only). So a NOTE is added to simplify it. It can be UE implementation to report reducedMaxCCs in legacy IE or new IE and the interpretation would be different.*  *For NE-DC case, based on the previous discussion it seems most of companies preferred not to apply this overheating enhancement to NE-DC case. As the “overheatingAssistanceForSCG” is only added in TS 36.331, and it only impacts (NG)EN-DC and “for SCG” is implicitly means “for NR SCG”.* |
| 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.  *[Rapporteur]: thanks for further explaining the intention of the NOTE, please also see the responses for Nokia’s comments above. Hope our understandings are aligned.* |
| 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.   *[Rapporteur]: in my understanding the legacy fields and new fields are independent and comprehension for the fields won’t be changed. If Rel-15 overheatingAssistanceConfig is configured, legacy fields can be reported by the UE and it is always interpreted as for MCG+SCG; If Rel-16 overheatingAssistanceConfigForSCG is configured, new fields can be reported by the UE and it is always interpreted as only for SCG. It minimizes the impacts on NW implementation for the legacy fields. I am open to hear other companies view for the mechanism provided by ZTE.* |
| Apple | Agree with the change, and share Ericsson’s view. |
| Samsung | For simplicity, the field reducedMaxCCs can be excluded from overheatingAssistanceForSCG. Since MN is responsible to control the number of CCs across MCG and SCG, there is no reason for UE to report the field via the overheatingAssiatanceForSCG. It could get just more complex.  *[Rapporteur]: thanks for the comments, I would add this issue in the phase2 discussion and invite companies to provide views on this proposal.* |
| Qcom | We support the addition the IE, only for the (NG)EN-DC case.  For NR-DC, no need to use this IE, MN-SN coordination is enough to settle on the proper configuration at the SN.  *[Rapporteur]: yes, as overheatingAssistanceForSCG-r16 is only added in TS 36.331, it is only for (NG)EN-DC.* |

### 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.**

|  |  |
| --- | --- |
| 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?  *[Rapporteur]: To clarify the set of changes for adding “allowedreducedXX” in addition to overheatingAssistanceSCG. In TEI16, SCG specific UAI is introduced so the overheatingAssistanceSCG is needed for forwarding SCG specific UAI from MN to SN. However, the set of changes for adding “allowedreducedXX” is actually not for SCG specific UAI, but for the legacy Rel-15 IE representing MCG+ SCG overheating information. The “allowedreducedXX” is used for coordination between MN and SN for based on MCG+ SCG overheating information to support the overheating mechanism well.* |
| 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.  *[Rapporteur]: please see the responses for OPPO’s comments above. Besides, we find that the existing fields in ConfigRestrictInfoSCG cannot be used for CCs, bandwidth and MIMO layer coordination to restrict the SN configuration, so the set of “allowedreducedXX” is added.* |
| 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.  *[Rapporteur]: please see the responses in 2.5.* |
| Nokia, Nokia Shanghai Bell | We need to understand the meaning of the new field signaled by the UE vs. the legacy one. Knowing that we can look at the information that is transferred to the SN  *[Rapporteur]: if the legacy IEs (interpreted as MCG+SCG) are received from the UE, the coordination between MN and SN is needed, and the set of “allowedreducedXX” added can be used to restrict the SN configuration. If the new Ies (interpreted as SCG only) are received from the UE, MN can just forward this information to SN using “overheatingAssistanceSCG” in inter-node message.* |
| NTT DOCOMO | Since NR overheating information encapsulated in LTE overheating message only concerns NR information, why not just forwarding the encapsulated meassage to SN?  *[Rapporteur]: please see the responses for OPPO’s and Nokia’s comments above. And as indicated by ZTE for ASN.1 design,*  overheatingAssistanceSCG OverheatingAssistance  *should be*  overheatingAssistanceSCG OCTET STRING (CONTAINING OverheatingAssistance)  *I agree that MN only needs to forward 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?  *[Rapporteur]: please see the responses for OPPO’s and Nokia’s comments above.* |
| Ericsson | 1. 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.  *[Rapporteur]: yes, the overheatingAssistanceSCG is only used for (NG)EN-DC case and when the new Ies (SCG specific UAI is reported) is reported by UE. It seems the field description for overheatingAssistanceSCG in CG-ConfigInfo is missed, maybe I can add it like:*  ***overheatingAssistanceSCG***  Contains the IE OverheatingAssistance for overheating assistance information for NR SCG reported by the UE (see TS 36.331 [10]). This field is only used in (NG)EN-DC. |
| 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.  *[Rapporteur]: thanks for spotting this. If I add the field description for overheatingAssistanceSCG in CG-ConfigInfo (as above), do you think it is clear enough?* |
| 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;  *[Rapporteur]: for b)#, allowedreducedMaxCCs can used in (NG)EN-DC and NR-DC, since reducedCCsDL/UL interpreted as across MCG and SCG is supported in (NG)EN-DC and NR-DC, the coordination is needed. But for allowedreducedMaxBW and allowedreducedMaxMIMO-Layers, these are only for NR-DC, these information is not reported by UE in (NG)EN-DC. Based on previous discussion, it seems most of companies preferred not to apply this overheating enhancement to NE-DC case.*  *For the ASN.1 design for b)#, thanks for the good suggestion, if my understanding above is correct, maybe I can update it like:*  allowedConfigForOverheating OverheatingAssistance;  *For the comments for ASN.1 signaling, thanks for the careful reviews, I agree corrections 1 and 2. For the correction 3, could you please explain a bit more?* |
| Apple | Agree with the analysis and change. |
| Samsung | The parameter that the coordination is required, i.e. reducedMaxCCs can be provided by the existing field sourceConfigSCG in CG-ConfigInfo, i.e. after the responsible MN makes a decision, the MN will request the corresponding reconfiguration to SN by using existing field.  (cf. as in 2.1, it seems preferable that the field reducedMaxCCs is excluded from overheatingAssistanceForSCG)  For the parameters that the coordination is not required, a container can be used.  *[Rapporteur]: I agree that the coordination is required but I am not sure how to perform by using existing field sourceConfigSCG, could you please explain more? For the allowedreducedMaxBW and allowedreducedMaxMIMO, actually it is not needed for (NG)EN-DC but is intended for NR-DC, as overheating assistance info for BW and MIMO are regarded as across MCG and SCG, so the coordination is needed as we do for allowedreducedMaxCCs.* |
| Qcom | **For (NG)EN-DC case**:  MN only needs to include the “allowedMaxReducedCC” to SN. In addition the MN sends to entire NR container of the “overheatingAsisstanceForSCG” to SN for the purpose of MN-SN reducedMaxCC parameters coordination.  Our understanding for the coexistence of the legacy IE (overheatingAsisstanceInfo) and new Rel.16 IE (overheatingAsisstanceInfoForSCG) is:   * if legacy IE is transmitted only 🡪 it’s addressing configuration at MN and SN collectively * if new IE is only transmitted 🡪 addressing configuration at SN only * if both IEs are transmitted 🡪 legacy is intended (reducedMaxCC) for both MN and SN, whereas new IE is intended for SN only 🡪   **Based on this, Note5 is not needed.**  **For NR-DC case**:  No need to introduce any new IE in UE RRC, legacy behavior still applicable, where overheatingAsisstanceInfo is destined for the MN, however it covers the MN and SN reduced configuration. MN-SN coordination is required, using the new defined inter-node messages.  *[Rapporteur]: thanks for the comments, I would add the Note5 issue in the phase2 discussion and invite companies to provide views on this proposal.* |

### 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.**

|  |  |
| --- | --- |
| 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  *[Rapporteur]: as explained by Ericsson, it does not impact legacy Rel-15 mechanism, it only indicate UE is capable of reporting new SCG specific UAI (introduced in Rel-16), the NW can decide whether the UE is allowed to report new overheating IE (interpreted as only for SCG) based on this capability.* |
| NTT DOCOMO | Agree with Nokia  *[Rapporteur]: please see the responses for Nokia’s comments above.* |
| 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 |
| Apple | OK |
| Samsung | Fine with a LTE capability |
| Qcom | 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.**

|  |  |
| --- | --- |
| 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  ]]  }  *[Rapporteur]: based on the field description for nr-SecondaryCellGroupConfig:*  Includes the NR *RRCReconfiguration* message as specified in TS 38.331 [82]. In this version of the specification, the NR RRC message only includes fields *iab-F1AP-TransferOverSRB-r16*, *secondaryCellGroup, conditionalReconfiguration* and/ or *measConfig*.  *So the NR SN cannot configure OtherConfig-v1540 to UE in (NG)EN-DC, there is no problem.* |
| 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  *[Rapporteur]: OK, I will fix it.* |
| 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.  *[Rapporteur]: in my understanding the legacy fields and new fields are independent and comprehension for the fields won’t be changed. So it should be allowed that the NW* ***only*** *configures overheatingAssistanceForSCG to enable the UE* ***only*** *to report new IEs (SCG specific UAI). If the new configuration is an extension of the legacy configuration field, does it means the new reporting and the legacy reporting are enabled simultaneously? So only configuring new reporting cannot be supported.* |
| Vivo | We are fine with this change. |
| Ericsson | Agree with Docomo.  *[Rapporteur]: please see the responses for DOCOMO’s comments above.* |
| 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?  *[Rapporteur]: please see the responses for DOCOMO’s comments above. So now I understand the point is that if the NW can enable only one overheating reporting in (NG)EN-DC, (i.e. only allow UE to report either legacy fields or new fields), or the NW can enable both new reporting and legacy reporting.*  *Actually I don’t see the problem if both new and legacy reporting can be enable simultaneously, since the configuration and operation can be independent using its respective prohibit timer. The only issue is that reducedMaxCCs may be included in both legacy IE and new IE if both are enabled, so the NOTE 5 is added to address this issue.* |
| Apple | Agree with the change. |
| Samsung | Share with Docomo and Ericsson  *[Rapporteur]: thanks for the comments, I would add the configuration issue in the phase2 discussion and invite companies to provide views on this proposal.* |
| Qcom | Agree with the changes … we support the idea where only one prohibit timer is used to track both IEs (legacy and new IEs).  *[Rapporteur]: thanks for the comments, I would add the configuration issue in the phase2 discussion and invite companies to provide views on this proposal.* |

### 2.5 Other

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

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| Company | Comments |
| Google | We think a MN-SN coordination is needed for the MN to know the SN supports *overheatingAssistanceForSCG*.  *[Rapporteur]: I understand the overheatingAssistanceForSCG is mainly used by SN, so it seems reasonable that SN can indicates if SN expects to receives SCG specific UAI to the MN. To simplify the solution, in (NG)EN-DC, SN can indicate the preference on receiving SCG specific UAI (i.e. adding one bit in CG-Config), then MN decides the finial configuration for SCG specific UAI.* |
| 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; |   *[Rapporteur]: it seems the copied context is not from our latest version R2-2003467 but our previous CR. The spotted issue is right and it has been corrected in R2-2003467:*  1> if configured to provide overheating assistance indication for SCG:  2> 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.   *[Rapporteur]: please see some responses in 2.4.*  *In my understanding the legacy fields and new fields are independent and comprehension for the fields won’t be changed. If Rel-15 overheatingAssistanceConfig is configured, legacy fields can be reported by the UE and it is always interpreted as for MCG+SCG; If Rel-16 overheatingAssistanceConfigForSCG is configured, new fields can be reported by the UE and it is always interpreted as only for SCG.*  *As some companies comments in 2.4, it is not clear if the NW can enable only one overheating reporting in (NG)EN-DC, (i.e. only allow UE to report either legacy fields or new fields), or the NW can enable both new reporting and legacy reporting. Actually I don’t see the problem if both new and legacy reporting can be enable simultaneously, since the configuration and operation can be independent. The only issue is that reducedMaxCCs may be included in both legacy IE and new IE if both are enabled, so the NOTE 5 is added to address this issue.*  *This problem can be avoid if only one overheating reporting can be enabled (it is actually you proposed Alt-1). If it is allowed that both new and legacy reporting can be enable simultaneously, Alt-2 could be further discussed. I am happy to hear companies views.*   * Agree with Google comments about MN-SN coordination.   *[Rapporteur]: please see the responses for Google’s comments above.* |
| 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  *[Rapporteur]: I understand it is related to the discussion in 2.4 that if the configuration for legacy fields and new fields are independent. If they are independent, I understand the procedure texts for legacy reporting and new reporting are independently described.* |
| 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.  *[Rapporteur]: please see the responses for Google’s comments above, a simple one-bit indicator can be introduced for simplifying the solution.*  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”.  *[Rapporteur]: generally OK. But it depends on the discussion in 2.4 that if the NW can enable only one overheating reporting in (NG)EN-DC, (i.e. only allow UE to report either legacy fields or new fields), or the NW can enable both new reporting and legacy reporting. If the former one is preferred, I understand the NOTE 5 is not needed.* |
| Qcom | The intention of our proposal is to keep the changes at minimal at Network and UE.  **For (NG)EN-DC**:   * new IE that is introduced to target reduced configuration at the SCG, except for the ReducedMaxCC, where MN-SN coordination is required. SgNB has better idea on NR SCG overheating * Legacy IE when transmitted by UE, irrespective if it was by itself or simultaneously with the new IE, it will have the same impact on the network, i.e. used to figure out the reduced configuration on the MN and SN * New IE, is solely intended to SN, and used to figure out the reduced configuration at the SN, except for the ReducedMaxCC, which is determined after MN-SN coordination.   **For NR-DC**: no need to introduce any new IE, same legacy IE can be used with the same current mechanism, only addition is to have MN-SN coordination is required to decide on the final reduced configuration.  NG SCG usually consumes more power than LTE MCG. gNB has better understanding than eNB on how to save UE power consumption in NR.  We should enable SN to send proposed value of *allowedreducedMaxCCs* in *CG-Config*.  Similarly, to enable SN negotiation with MN for the shared OA parameters, we can add allowedreducedMaxBW, allowedreducedMaxMIMO-Layers parameters into *CG-Config*.  *[Rapporteur]: thanks for the comments, I would add this issue in the phase2 discussion and invite companies to provide views on this proposal.* |
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## 3 Discussion (phase 2)

Based on the feedbacks from companies as far, I list the following issues which seems a bit controversial and needs to be discussed.

### 3.1 NW configuration for new overheating IE (overheatingAssistanceForSCG-r16) in (NG)EN-DC

As raised by DOCOMO/Ericsson/Samsung/ZTE, configuration for new overheating IE comes together with the configuration for legacy overheating IE, the mechanism is described as below:

* If the NW only configures legacy reporting, UE can report legacy overheating IE (overheatingAssistance-r14)
* If the NW configures legacy reporting with new reporting enabled, UE can report legacy overheating IE (overheatingAssistance-r14) and/or new overheating IE (overheatingAssistanceForSCG-r16). It is up to UE implementation if only legacy overheating IE, or new overheating IE or both is reported

To be noted, the prohibit timer is shared. Only enabling UE to report new overheating IE cannot be supported.

**3.1-1 Companies are encouraged to confirm the above understanding or provide the comments.**

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| Company | Comments |
| Qcom | in mostly we carry the same understanding as proposed above:   * Network can configure only legacy reporting 🡪 legacy reporting and behavior is expected * Network can configure legacy and new reporting 🡪 UE specific implementation whether legacy or new reporting will be used.   + For this case, if both reported (legacy + new) 🡪 legacy report is meant for MN+SN (as legacy behavior) and new report is meant for SN reduced configuration. MN-SN coordination to determine the final reduced configuration on SN. * Not sure why we’re imposing this restriction “Only enabling UE to report new overheating IE cannot be supported.” … but no strong view. * We prefer a shared prohibit timer, but open to the idea to have 2 independent timers |
| Ericsson | We agree with the rapporteur described behavior above, except for the part “It is up to UE implementation if only legacy overheating IE, or new overheating IE or both is reported”. Our understanding is that the TEI-16 part is merely an addition to the existing behavior and thus the UE would have to at least support the legacy overheating behavior if it would want to support this TEI-16 behavior. |
| Google | We share the same understanding. |
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Based on the above understanding, there are two potential interpretations for the legacy overheating IE

1. the interpretation for the legacy overheating IE is not changed, i.e. it is always interpreted as the preference for MCG+SCG (DOCOMO/Ericsson/Samsung)
2. the interpretation for the legacy overheating IE is changed according to the configuration (ZTE)

* If the NW only configures legacy reporting, UE can report legacy overheating IE (overheatingAssistance-r14) and it is interpreted as preference for MCG+SCG
* If the NW configures legacy reporting with new reporting enabled, the legacy overheating IE is interpreted as preference for MCG only instead of preference for MCG+SCG

**3.1-2 Companies are encouraged to provide the views on the above Alt 1) and Alt 2).**

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| Company | Comments |
| Qcom | We don’t see the reason for changing the legacy behavior, therefore we support interpretation#1, i.e. legacy configuration indicates legacy behavior irrespective if new reporting is enabled/configured. |
| Ericsson | We also prefer to keep the MN behavior as it is now, regardless of the additions from Rel-16, thus interpretation 1. |
| Google | We don’t want to change the legacy behavior so we prefer interpretation#1. |
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The example of ASN.1 design is given below.

[[ overheatingAssistanceConfig-r14 CHOICE{

release NULL,

setup SEQUENCE{

overheatingIndicationProhibitTimer-r14 ENUMERATED {s0, s0dot5, s1, s2, s5, s10,

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

spare3, spare2, spare1}

}

} OPTIONAL -- Need ON

]],

*Omitted…*

[[overheatingAssistanceConfigForSCG-r16 ENUMERATED { enabled } OPTIONAL -- Cond overheating

]]

}

| **Conditional presence** | **Explanation** |
| --- | --- |
| *overheating* | The field is optionally present if *overheatingAssistanceConfig* is present, need ON. Otherwise the field is not present. |

**3.1-3 Companies are encouraged to provide the comments for above siganlling design.**

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| Company | Comments |
| Qcom | Fine with us |
| Ericsson | Fine with this approach, but to have means to release the overheatingAssistanceConfigForSCG we could use a setup release? |
| Google | The ASN.1 change looks ok. |
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### 3.2 The handling of reducedMaxCC and the NOTE 5

Based on the understanding above, there is the case that UE may report both legacy overheating IE (overheatingAssistance-r14) and new overheating IE (overheatingAssistanceForSCG-r16). reducedMaxCC is a special IE that can be included in the legacy and the new overheating IE. There are several ways to handle this reducedMaxCC:

1. UE is restricted not to include reducedMaxCCs in both legacy overheating IE (overheatingAssistance-r14) and new overheating IE (overheatingAssistanceForSCG-r16) simultaneously, as the NOTE 5 presents.
2. reducedMaxCCs is excluded from the new overheating IE (overheatingAssistanceForSCG-r16). If it is agreed, the restriction should be capture in the spec.
3. UE can report reducedMaxCCs in both legacy overheating IE (overheatingAssistance-r14) and new overheating IE (overheatingAssistanceForSCG-r16), reducedMaxCCs in legacy IE is intended for MCG+SCG, reducedMaxCCs in new IE is intended for only SCG. If it is agreed, there are no impacts on the spec.

**3.2 Companies are encouraged to provide the views on the above Alt 1), Alt 2) and Alt 3).**

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| Company | Comments |
| Qcom | Alt-3 is preferred  Alt-1 will prevent proper MN-SN coordination, as one of the node won’t have the full picture, i.e. the ReduceMaxCC  Alt-2 same caveat as Alt-1 |
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| Ericsson | We think Alt-1 would avoid changes to current MN behavior. In this case, if e.g. reducedMaxCC corresponds solely to the SCG, then it could include in the SCG report which the MN would forward to the SN and would not have to take actions on reducedMaxCC. |
| Google | Alt-1 is preferred. Alt-3 may require more MN-SN coordination, which is complicated. |
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### 3.3 MN-SN coordination

As raised by Google/BT, MN needs to know the SN supports overheatingAssistanceForSCG. I consider that it is beneficial that SN can indicate the preference for enabling the SCG specific overheating assistance info reporting. Considering that the SCG specific UAI is mainly used by SN, if SN has no expectation of receiving SCG specific overheating assistance info or adjusting the SN configuration for the UE based on it, actually the UE should not be allowed to report SCG specific UAI, otherwise it leads to unnecessary signaling overhead and resources wastes. So I understand it would be good to let MN know the SN’s preference, the MN can consider the preference from the SN and makes the final decision.

**3.3-1 Companies are encouraged to provide the comments for above proposal.**

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| Company | Comments |
| Qcom | MN-SN coordination at this level is needed, otherwise the impact won’t be limited to the overhead signaling, but also it might compromise the effectiveness of the legacy feature. |
| Ericsson | We don’t think this is up to MN/SN interaction. We agree the additional overheating report should only be configured if both MN and SN are upgraded for this – this is just a consequence that if the NW wants to use such overheating report it would have to have both nodes upgraded. It would anyway not work if e.g. MN is upgraded and may configure the SCG report to the UE but SN is not upgraded, or if SN is upgraded but while indicating this to the MN it cannot understand because the MN was not upgraded. We think this is just as any other case where if the NW would want to use the feature it can anyway only work if both MN and SN support the feature. |
| Google | Considering different deployment scenarios (e.g., intra-vendor, inter-vendor), MN-SN coordination is needed to ensure the UE receives a valid configuration. |
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As raised by Qualcomm, NG SCG usually consumes more power than LTE MCG. gNB has better understanding than eNB on how to save UE power consumption in NR. SN can be enabled to send proposed value of allowedreducedMaxCCs in *CG-Config*. Similarly, to enable SN negotiation with MN for the shared overheating parameters, we can add *allowedreducedMaxBW*, *allowedreducedMaxMIMO-Layers* parameters into *CG-Config*.

**3.3-2 Companies are encouraged to provide the comments for above proposal.**

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| Company | Comments |
| Qcom | to have this feature fully effective, the feedback from SN is strongly needed. |
| Ericsson | On allowedreducedMaxCCs, if the MN could simply adopt the allowedreducedMaxCCs suggested by the SN why it took a decision in the first place? We think there would be no need to further change the MN behavior for the UE reported reducedMaxCCs. For *allowedreducedMaxBW*, *allowedreducedMaxMIMO-Layers* the MN is not mandated to understand such NR fields in EN-DC, so we do not think they can be introduced. |
| Google | The UE has the best understanding on how to save its power in NR SCG and would indicate preferred overheating parameters in the SCG specific UAI based on the understanding. The SN just follows the UE’s preference in the SCG specific UAI to reconfigure SCG. Therefore, we don’t see any gain to introduce the SN proposed parameters in the CG-Config. |
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### 3.4 Other

**3.4 Please provide the comments not covered by above discussion if any.**

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| Company | Comments |
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