**3GPP TSG RAN WG1 Meeting #109-e** **R1-22xxxxx**

**e-Meeting, May 9th – 20th, 2022**

**Agenda Item: 8.13**

**Source: Moderator (Huawei)**

**Title:** **[Draft] [109-e-R17\_DSS-02] Summary of Further Multi-RAT Dual-Connectivity enhancements**

**Document for: Discussion and Decision**

# Introduction

This summary is for the following email discussion.

[109-e-R17\_DSS-02] Email discussion for maintenance on further MR-DC/CA Enhancement, including Issue-1, Issue-2 and Issue-3 of moderator’s proposals in the FL summary R1-2205179 – Frank(Huawei)

         Discussion and decision by 5/18

# Summary of issues

According to all of contribution papers, three issues are summarized below.

* **Issue-1:** CA:Clarification for the cell of the reference slot in [TS 38.214]. [1]
* **Issue-2:** NR-DC: Power allocation between MCG and SCG when SCG is deactivated.[3] [2]
* **Issue-3:** NR-DC:UE determination of PDCCH monitoring when SCG is deactivated for NR-DC. [2]

## TP for Issue-1:

In [1], TP for clarification for the cell of the reference slot for fast SCell activation is provided.

**----------------------------------------**Text Proposal for Section 5.2.1.5.3 in TS 38.214 h10**------------------------------------**

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| ***Reason for change:*** There is ambiguous for fast SCell activation because the cell of the reference slot *n+k* is a PUCCH cell which may be different with the cell of MAC-CE received in slot *n*.***Summary of change:*** To correct the cell of the reference slot *n+k*.***Consequences if not approved:*** The timeline of the fast cell activation is impacted due to the ambiguous cell of the reference slot. |
| 5.2.1.5.3 Aperiodic CSI-RS for tracking for fast SCell activationWhen the UE receives an *Enhanced Scell Activation/Deactivation* MAC-CE that triggers one or two CSI-RS bursts for fast SCell activation for a (set of) deactivated SCell(s),- if the MAC-CE indicates that the first CSI-RS burst for SCell activation is present in an SCell, then the UE may assume that the first CSI-RS burst for SCell activation is present in that SCell. The first slot of the first CSI-RS burst starts at the *m1*th SCell slot after the last SCell slot coinciding with the reference slot *n+k*, as defined in clause 4.3 of [6, TS38.213], of the cell in which the PUCCH with HARQ-ACK information for the MAC-CE reception was transmitted.- if the MAC-CE indicates that the second CSI-RS burst for SCell activation is present in an SCell, then the UE may assume that the second CSI-RS burst for SCell activation is present in that SCell. The first slot of the second CSI-RS burst starts at the *m2*thSCell slot after the end of the first CSI-RS burst. The CSI-RS of the second burst shall have the same antenna port index, OFDM symbol allocations in a slot, same PRB allocation location as the CSI-RS of the first burst.- Where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots in clause 5.1.6.1.1.1, and *m1* and *m2* are provided by the MAC-CE and higher layer configuration. |

## TP for Issue-2:

**Observation 1**: *The NR-DC semi-static power sharing modes keep the SCG power allocation even if the SCG is deactivated.*

**Proposal 1:** *Update the TS38.213 subclause 7.6.2 to allocate all the TX power to the MCG when the SCG is deactivated*

**Proposal 2:** *Select one of the two possible TP alternatives below*

**Alternative 1**

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| 7.6.2 NR-DCIf a UE is configured with an MCG using NR radio access in FR1 or in FR2 and with a SCG using NR radio access in FR2 or in FR1, respectively, the UE performs transmission power control independently per cell group as described in clauses 7.1 through 7.5.If a UE is configured with an MCG and a SCG using NR radio access in FR1 and/or in FR2, the UE is configured a maximum power $P\_{MCG}$ for transmissions on the MCG by *p-NR-FR1* and/or by *p-NR-FR2* and a maximum power $P\_{SCG}$ for transmissions on the SCG by *p-NR-FR1* and/or by *p-NR-FR2* and with an inter-CG power sharing mode by *nrdc-PCmode-FR1* for FR1 and/or by *nrdc-PCmode-FR2* for FR2. The UE determines a transmission power on the MCG and a transmission power on the SCG per frequency range.If a UE is provided *semi-static-mode1* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2*,or *semi-static-mode2* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2*, the UE does not expect $P\_{MCG}$ and $P\_{SCG}$ to be configured such that $\hat{P}\_{MCG}+\hat{P}\_{SCG}>\hat{P}\_{Total}^{NR-DC}$, where $\hat{P}\_{MCG}$ is the linear value of $P\_{MCG}$, $\hat{P}\_{SCG}$ is the linear value of $P\_{SCG}$, and $\hat{P}\_{Total}^{NR-DC}$ is the linear value of a configured maximum transmission power for NR-DC operation in FR1 or FR2 as defined in [8-3, TS 38.101-3].If a UE is provided *semi-static-mode1* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2*, - if the SCG is activated, the UE determines a transmission power for the MCG or for the SCG as described in clauses 7.1 through 7.5 using $P\_{MCG}$ or $P\_{SCG}$ as the maximum transmission power, respectively.- if the SCG is deactivated, the UE determines the MCG tranmission power as if the UE was not configured with SCG.If a UE is provided *semi-static-mode2* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2* and the SCG is activated,- if the UE is not provided *tdd-UL-DL-ConfigurationCommon* for the MCG or SCG, the UE determines a transmission power for the MCG or for the SCG as described in clauses 7.1 through 7.5 using $P\_{MCG}$ or $P\_{SCG}$ as the maximum transmission power, respectively - if at least one symbol of slot $i\_{1}$ of the MCG or of the SCG that is indicated as uplink or flexible to a UE by *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated*, if provided, overlaps with a symbol for any ongoing transmission overlapping with slot $i\_{2}$ of the SCG or of the MCG, respectively, the UE determines a power for the transmission on the SCG or the MCG overlapping with slot $i\_{2}$ as described in clauses 7.1 through 7.5 using $P\_{SCG}$ or $P\_{MCG}$, respectively, as the maximum transmission power- otherwise, the UE determines a power for the transmission on SCG or the MCG overlapping with slot $i\_{2}$, as described in [8-3, TS 38.101-3] and in clauses 7.1 through 7.5 without considering $P\_{SCG}$ or $P\_{MCG}$ respectivelyIf a UE is provided *semi-static-mode2* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2* and the SCG is deactivated, the UE determines the MCG tranmission power as if the UE was not configured with SCG.The UE expects to be provided *semi-static-mode2* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2* only for synchronous NR-DC operation [10, TS 38.133].[\*\*\*\*\*\*\*\*\*\* unchanged part of the subcluse not shown \*\*\*\*\*\*\*\*\*\*\*\*\*\* ]  |

**Alternative 2**

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| 7.6.2 NR-DCIf a UE is configured with an MCG using NR radio access in FR1 or in FR2 and with a SCG using NR radio access in FR2 or in FR1, respectively, the UE performs transmission power control independently per cell group as described in clauses 7.1 through 7.5.If a UE is configured with an MCG and a SCG using NR radio access in FR1 and/or in FR2 and at least one cell in the SCG is activated, the UE is configured a maximum power $P\_{MCG}$ for transmissions on the MCG by *p-NR-FR1* and/or by *p-NR-FR2* and a maximum power $P\_{SCG}$ for transmissions on the SCG by *p-NR-FR1* and/or by *p-NR-FR2* and with an inter-CG power sharing mode by *nrdc-PCmode-FR1* for FR1 and/or by *nrdc-PCmode-FR2* for FR2. The UE determines a transmission power on the MCG and a transmission power on the SCG per frequency range.If the SCG is deactivated, the UE determines the MCG tranmission power as if the UE was not configured with SCG.If a UE is provided *semi-static-mode1* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2*,or *semi-static-mode2* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2*, the UE does not expect $P\_{MCG}$ and $P\_{SCG}$ to be configured such that $\hat{P}\_{MCG}+\hat{P}\_{SCG}>\hat{P}\_{Total}^{NR-DC}$, where $\hat{P}\_{MCG}$ is the linear value of $P\_{MCG}$, $\hat{P}\_{SCG}$ is the linear value of $P\_{SCG}$, and $\hat{P}\_{Total}^{NR-DC}$ is the linear value of a configured maximum transmission power for NR-DC operation in FR1 or FR2 as defined in [8-3, TS 38.101-3].If a UE is provided *semi-static-mode1* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2*, the UE determines a transmission power for the MCG or for the SCG as described in clauses 7.1 through 7.5 using $P\_{MCG}$ or $P\_{SCG}$ as the maximum transmission power, respectively.If a UE is provided *semi-static-mode2* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2*- if the UE is not provided *tdd-UL-DL-ConfigurationCommon* for the MCG or SCG, the UE determines a transmission power for the MCG or for the SCG as described in clauses 7.1 through 7.5 using $P\_{MCG}$ or $P\_{SCG}$ as the maximum transmission power, respectively - if at least one symbol of slot $i\_{1}$ of the MCG or of the SCG that is indicated as uplink or flexible to a UE by *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated*, if provided, overlaps with a symbol for any ongoing transmission overlapping with slot $i\_{2}$ of the SCG or of the MCG, respectively, the UE determines a power for the transmission on the SCG or the MCG overlapping with slot $i\_{2}$ as described in clauses 7.1 through 7.5 using $P\_{SCG}$ or $P\_{MCG}$, respectively, as the maximum transmission power- otherwise, the UE determines a power for the transmission on SCG or the MCG overlapping with slot $i\_{2}$, as described in [8-3, TS 38.101-3] and in clauses 7.1 through 7.5 without considering $P\_{SCG}$ or $P\_{MCG}$ respectivelyThe UE expects to be provided *semi-static-mode2* for *nrdc-PCmode-FR1* or for *nrdc-PCmode-FR2* only for synchronous NR-DC operation [10, TS 38.133].[\*\*\*\*\*\*\*\*\*\* unchanged part of the subcluse not shown \*\*\*\*\*\*\*\*\*\*\*\*\*\* ] |

In [2], in case of SCG deactivation, a TP is proposed for UL power control.

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| TP #2 for [TS 38.213]7.6 Dual connectivityThe UE procedures described in clauses 7.6.1 through 7.6.2 are not applicable if the UE is provided *scg-State* [12, TS 38.331].…… |

## TP for Issue-3:

In [2], in case of SCG deactivation, a TP for UE determination on PDCCH blind detection is proposed for NR-DC.

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| TP #2 for [TS 38.213]……10 UE procedure for receiving control information…When a UE is configured for NR-DC operation and is not provided *scg-State* [12, TS 38.331], the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per slot that corresponds to $N\_{cells}^{cap}=N\_{cells}^{MCG}$ downlink cells for the MCG where $N\_{cells}^{MCG}$ is provided by *pdcch-BlindDetection* for the MCG and determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per slot that corresponds to $N\_{cells}^{cap}=N\_{cells}^{SCG}$ downlink cells for the SCG where $N\_{cells}^{SCG}$ is provided by *pdcch-BlindDetection* for the SCG. When the UE is configured for carrier aggregation operation over more than 4 cells, or for a cell group when the UE is configured for NR-DC operation and is not provided *scg-State*, the UE does not expect to monitor per slot a number of PDCCH candidates or a number of non-overlapped CCEs that is larger than the maximum number as derived from the corresponding value of $N\_{cells}^{cap}$. …When a UE is configured for NR-DC operation, and is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for all downlink cells where the UE monitors PDCCH, and is not provided *scg-State*, the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per span that corresponds to- $N\_{cells}^{cap-r16}= N\_{cells, r16}^{MCG}$ downlink cells for the MCG where $N\_{cells, r16}^{MCG}$ is provided by *pdcch-BlindDetection2* for the MCG, and - $N\_{cells}^{cap-r16}= N\_{cells, r16}^{SCG}$ downlink cells for the SCG where $N\_{cells, r16}^{SCG}$ is provided by *pdcch-BlindDetection2* for the SCG…When a UE is configured for NR-DC operation, is not provided *scg-State*, and is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for at least one downlink cell and *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one downlink cell where the UE monitors PDCCH, the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs that corresponds to- $N\_{cells,r15}^{cap-r16}= N\_{cells, r15}^{MCG}$ downlink cells for the MCG where $N\_{cells, r15}^{MCG}$ is provided by *pdcch-BlindDetection3* for the MCG,- $N\_{cells,r15}^{cap-r16}= N\_{cells, r15}^{SCG}$ downlink cells for the SCG where $N\_{cells, r15}^{SCG}$ is provided by *pdcch-BlindDetection3* for the SCG, and- $N\_{cells,r16}^{cap-r16}= N\_{cells, r16}^{MCG}$ downlink cells for the MCG where $N\_{cells, r16}^{MCG}$ is provided by *pdcch-BlindDetection2* for the MCG,- $N\_{cells,r16}^{cap-r16}= N\_{cells, r16}^{SCG}$ downlink cells for the SCG where $N\_{cells, r16}^{SCG}$ is provided by *pdcch-BlindDetection2* for the SCG … |

# Discussions

## Issue#1: CA: Clarification for the cell of the reference slot in [TS 38.214]

The TP for discussion can be found in S2.1.

Companies’ views are welcome.

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| *Company* | *View* |
| vivo | Some discussions/clarifications would be necessary.- if the MAC-CE indicates that the first CSI-RS burst for SCell activation is present in an SCell, then the UE may assume that the first CSI-RS burst for SCell activation is present in that SCell. The first slot of the first CSI-RS burst starts at the *m1*th SCell slot after the last SCell slot coinciding with the reference slot *n+k*, as defined in clause 4.3 of [6, TS38.213], of the cell in which the MAC-CE was received.The problem is whether the highlighted clause is to describe the “reference slot n+k”, or the “last SCell slot”. The proposed TP seems to assume the former one, however, the “reference slot n+k” is defined in clause 4.3 of 38.213, which already very clear defines that the reference slot is in the cell for PUCCH transmission. Moreover, in this case the “last SCell slot” is not very clear on which cell this slot associated to.Nevertheless, in this sense the highlighted clause may be incorrect, as the TRS burst may be transmitted in a SCell other than a cell receiving MAC CE. Thus, there might be several potential options, e.g.:Opt-0: The proposed TP.Opt-1: Remove the highlighted clause.Opt-2: Modify and move the clause after the “last SCell slot”… at the *m1*th SCell slot after the last SCell slot of the cell indicated by the MAC-CE coinciding with the reference slot *n+k*, as defined in clause 4.3 of [6, TS38.213].Opt-1 seems simplest, though not crystal clear. We would like to hear companies’ views. |
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## Issue#2: NR-DC: Power allocation between MCG and SCG when SCG is deactivated

Because the feature of SCG deactivation does not apply to NE-DC and the LTE power control in EN-DC is independent of NR SCG, the TP in [2] seems to have unnecessary impact on EN-DC and NE-DC. Here, the TP in [3] (refers to S2.2), which has changes only in S7.6.2 of TS 38.213, is suggested to be a starting point.

Firstly, companies are encouraged to check whether the following statement in the TP is correct or not.

**Q1: At least for semi-static power sharing, whether the following statement for NR-DC is correct or not**

“If the SCG is deactivated, the UE determines the MCG tranmission power as if the UE was not configured with SCG.”

Then, regarding how to reflect the outcome for Q1, companies are also encouraged to feedback which alternative in [3] is better and any appropriate changes.

**Q2: For uplink power control of NR-DC, which alternative in [3] is better or any appropriate changes?**

Companies’ views are welcome.

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| *Company* | *View* |
| vivo | We agree that SCG deactivation is only applicable to NR-DC. On the other hand, the TP in [2] seems to simpler and future-proof. Maybe a modified version would be acceptable:The UE procedures described in clause~~s 7.6.1 and through~~ 7.6.2 is ~~are~~ not applicable if the UE is provided *scg-State* [12, TS 38.331]. |
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## Issue#3: NR-DC: UE determination of PDCCH monitoring when SCG is deactivated for NR-DC

In [4], it has been specified for deactivated SCG that PDCCH monitoring on SCG is not required and uplink transmissions on SCG is not allowed. Whether the TP in S2.3 for issue#3 is necessary or not and any appropriate change are discussed.

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| 7.x        Activation and Deactivation of SCGTo enable reasonable UE battery consumption while having fast usage of SCG when MR-DC is configured, an activation/deactivation mechanism of SCG is supported. While the SCG is deactivated, there is no transmission via SCG RLC bearers. Only the NR SCG can be deactivated, and all SCG SCell(s) are in deactivated state while the SCG is deactivated.Note:         Upon SCG (de)activation, it is up to the network to ensure there is no pending SDUs or PDUs in SCG RLC entity (e.g. instructs the UE to perform PDCP data recovery and RLC re-establishment/release, if needed).While the SCG is deactivated, the UE will not transmit PUSCH, SRS and CSI report on SCG, and the UE is not required to monitor PDCCH on SCG. If configured by the network, the UE performs radio link monitoring on the SCG and beam failure detection on the SCG while SCG is deactivated. In case of SCG activation without performing random access, the network can indicate TCI states to UE for PDCCH/PDSCH reception on PSCell, if not provided, the UE uses the previously activated TCI states.  |

Companies’ views are welcome.

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| *Company* | *View* |
| vivo | Given the above text in [4], the PDCCH monitoring behavior is clear, thus the TP in S2.3 seems to be unnecessary. Further, it seems the intention of the TP is to reallocate the PDCCH blind decoding capabilities to MCG when SCG is deactivated, however, unlike the SCell deactivation done by MAC CE, the SCG deactivation is done by RRC. If the network would like to reallocate the PDCCH BD capabilities when deactivating the SCG (by configuring the RRC parameter *scg-State*), it may simply reconfigure the *pdcch-BlindDetection* together.  |
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# Conclusions

TBD

# References

1. [R1-2203196](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203196.zip) Maintenance of DSS and MR-DC ZTE

1. [R1-2203876](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203876.zip) Remaining details of NR dynamic spectrum sharing Samsung

1. [R1-2204822](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204822.zip) NR-DC uplink power sharing when SCG cells are deactivated Nokia, Nokia Shanghai Bell
2. R2-2203690 37340CR0309 (Rel-17, B) Introduction of further multi-RAT dual-connectivity enhancements, ZTE, CATT

# Appendix: Agreements

All RAN1 agreements and received LS’s can be found in [R1-2202934](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_108-e/Docs/R1-2202934.zip).